Allen-Bradley

New Product Announcement

PanelView Plus™ 700, 1000, 1250, and 1500

Bulletin 2711P

Move your platform applications into the future with the new Allen-Bradley PanelView Plus from Rockwell Automation. PanelView Plus is ideal for applications with a need to monitor, control, and display information graphically, allowing operators to quickly understand the status of their application. A cornerstone of the ViewAnyWare strategy, PanelView Plus is programmed with RSView Studio Machine Edition. It combines the best features from the popular Allen-Bradley PanelView Standard and PanelView "e" operator interface products and adds new functionality:

- Multi-vendor communications
- Trending
- Expressions
- Data logging
- Animation
- RSView Studio direct browsing of RSLogix 5000 addresses

With a new and innovative modular design, the PanelView Plus is a flexible, affordable terminal enabling OEMs, system integrators, and end users to select, modify, or upgrade components to meet changing application requirements. The memory, display, communication module, and front bezel can be installed with minimal effort using a simple screwdriver.

Your investment in PanelView products is protected with the ability to import existing PanelView Standard and PanelView "e" applications into RSView Studio. In addition, the PanelView Plus is designed to fit into current PanelView cutouts, so there is no need to modify your panel design. Whether it is providing more functionality, reducing development time, or simplifying future maintenance, PanelView Plus saves time and money.

Advantages

- High environmental specifications
- RSView ME advanced functionality
- Flexible communication options
- Modular design for flexibility, inventory reduction, and easy upgrades
- 6.5", 10.4", 12.1", and 15" TFT active matrix color displays with keypad, touch, and keypad/touch versions
- Unit level immediate exchange program
- Complete package for immediate startup
- Global sales and support

Rockwell Automation

PanelView Plus Selection Table

	Interface	Size	Display	Communication	Power	Memory Size
	K	7	C	4	D	1
	T	10		6	B	2
	B	12		15		(Flash/RAM)
		15				
2711P-						
	K=key	7=6.5 in	C=color TFT	4=Ethernet/RS232	D=DC	1=base (32/64)
	T=touch	10=10.4 in		6=DH+/RIO/DH485	B=AC DIN rail mounted	2=extended (128/128)
	B=both	12=12.1 in		15=ControlNet		
		15=15 in				

PanelView Plus Specifications

	PanelView Plus 700	PanelView Plus 1000	PanelView Plus 1250	PanelView Plus 1500
Display				
Size	6.5 in	10.4 in	12.1 in	15 in
Type	Color active matrix thin film transistor (TFT)			
Resolution	640 x 480, 24 bit color		800 x 600, 24 bit color	1024 x 768, 24 bit color
Input Method	Keypad, touch, or combination keypad/touch			
System Components				
Communication Options	ControlNet, DH+, Remote I/O, DH485, DF1, Ethernet/IP, and user configurable non-RA networks			
Flash Memory	Standard: 32 MB; extended: 128 MB			
RAM	Standard: 64 MB; extended: 128 MB			
I/O and Slots	1 serial port, 2 USB ports, 1 10/100 Mbps Ethernet port, 1 Compact Flash memory card slot			
Electrical				
Input Voltage	DC: 18-32V dc			
Environmental				
Operating Temperature	0...55˚C (32...131˚F)			
Storage Temperature	-25...70˚C (-13...158˚F)			
Humidity	5...95%, non-condensing @ 0...55˚C			
Vibration – Operating and Non-Operating	0.012 in p-p, 10…57 Hz, 2g peak, 57…500 Hz			
Shock – Operating/ Non-Operating	15g/30g			
Ratings	NEMA Type 12, 13, 4X*, IP54, IP65			
Certifications	UL, C-UL approved; Class 1/2/3 Div 2 Groups A, B, C, D; CE marked			
Mechanical				
Weight	Touch: 1.7kg (3.8 lb.)	Touch: 2.6 kg (5.7 lb.)	Touch: 3.2 kg (7.1 lb.)	Touch: 4.2 kg (9.3 lb.)
	Keypad or Keypad/Touch: 1.9 kg (4.2 lb.)	Keypad or Keypad/Touch: 2.9 kg (6.3 lb.)	Keypad or Keypad/Touch: 3.4 kg (7.6 lb.)	Keypad or Keypad/Touch: 4.6 kg (9.3 lb.)
Dimensions Overall (H x W x D)	Touch only: 179 x 246 x 55 mm (7.04 x 9.68 x 2.17 in)	Touch only: 248 x 329 x 55 mm (9.77 x 12.97 x 2.17 in)	Touch only: 282 x 363 x 55 mm (11.12 x 14.3 x 2.17 in)	Touch only: 330 x 416 x 65 mm (12.97 x 16.37 x 2.55 in)
	Keypad or Keypad/Touch: 193 x 290 x 55 mm (7.58 x 11.4 x 2.17 in)	Keypad or Keypad/Touch: 248 x 399 x 55 mm (9.77 x 15.72 x 2.17 in)	Keypad or Keypad/Touch: 282 x 416 x 55 mm (11.12 x 16.36 x 2.17 in)	Keypad or Keypad/Touch: 330 x 469 x 65 mm (12.97 x 18.46 x 2.55 in)
Cutout Dimensions	Touch only: 154 x 220 mm (6.08 x 8.67)	Touch only: 224 x 305 mm (8.8 x 12 in)	Touch only: 257 x 338 mm (10.11 x 13.29 in)	Touch only: 305 x 391 mm (12 x 15.4 in)
	Keypad or Keypad/Touch: 167 x 264 mm (6.57 x 10.39 in)	Keypad or Keypad/Touch: 224 x 375 mm (8.8 x 14.75 in)	Keypad or Keypad/Touch: 257 x 390 mm (10.11 x 15.35 in)	Keypad or Keypad/Touch: 305 x 419 mm (12 x 16.5 in)

* check for availability of outdoor rating

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Installation Instructions

PanelView Plus and VersaView CE High-Bright Display Modules

Catalog Numbers 2711P-RDT12H, 6189-RDT12H

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English

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About this Publication

This document provides instructions on how to install the PanelView Plus or VersaView CE High-Bright display module in a panel or enclosure.

Refer to the installation instructions shipped with the logic module and communication module for field installation of these components. For complete information on installing, wiring and troubleshooting the terminals, refer to the publications listed under Additional Resources.

Publication 2711P-IN026C-MU-P - September 2005

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc., is prohibited.

Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

WARNING	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard and recognize the consequences.
SHOCK HAZARD	Labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be at present.
BURN HAZARD	Labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be at dangerous temperatures.

Hazardous Locations

This equipment is suitable for:

- Class I, Division 2 Groups A, B, C, D
- Class I, Zone 2, Group IIC
- Class II, Division 2 Groups F, G
- Class III Division 1
- or ordinary (non-hazardous) locations only

The following statement applies to use in hazardous locations.

WARNING

Explosion Hazard

Substitution of components may impair suitability for hazardous locations.

Do not disconnect equipment unless power has been switched off and area is known to be non-hazardous.

Do not connect or disconnect components unless power has been switched off.

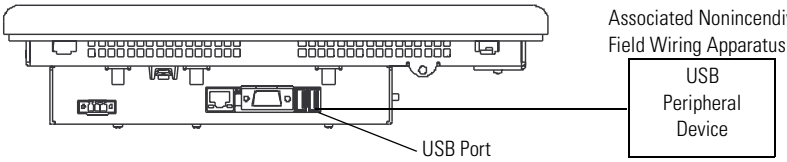
All wiring must comply with N.E.C. articles 501, 502, 503, and/or C.E.C. section 18-1J2 as appropriate.

Peripheral equipment must be suitable for the location it is used in.

The terminals have a temperature code of T4 when operating in a 55 °C (131 °F) maximum ambient temperature. Do not install the terminals in environments where atmospheric gases have ignition temperatures **less** than 135 °C (275 °F).

USB Ports

The terminals contain Universal Serial Bus (USB) ports which comply with hazardous location environments. This section details the field wiring compliance requirements and is provided in accordance with the National Electrical Code, article 500.



The USB peripheral device must be rated for the hazardous location environment in which it is used and also comply with the circuit parameters in Table 2.

The circuit parameters in Table 1 define the maximum voltage and current of the PanelView Plus and VersaView CE USB ports.

Table 1 - PanelView Plus and VersaView CE USB Port Circuit Parameters

Parameter	Value	Parameter Definition
V_{oc}	5.25V dc	Open circuit voltage of the host USB port.
I_{sc}	1.68 A	Maximum output current of the host USB port.

The circuit parameters in Table 2 define the maximum voltage, current, capacitance, and inductance values for any peripheral device connected to a PanelView Plus or VersaView CE USB port in a hazardous location environment.

Table 2 - Required Circuit Parameters for the USB Peripheral Device

Parameter	Value	Parameter Definition and Application Requirement
V_{max}	5.25V dc	Maximum applied voltage rating of the USB peripheral device. V_{max} shall be greater than or equal to V_{oc} in Table 1 ($V_{max} \geq V_{oc}$).
I_{max}	1.68 A	Maximum current to which the USB peripheral device can be subjected. I_{max} shall be greater than or equal to I_{sc} in Table 1 ($I_{max} \geq I_{sc}$).
C_a	10 µF	Maximum allowed capacitance of the USB peripheral device and its associated cable. The sum of C_{int} of the USB peripheral device and C_{cable} of the associated cable shall be less than or equal to C_a ($C_{int} + C_{cable} \leq C_a$).
L_a	15 µH	Maximum allowed inductance of the USB peripheral device and its associated cable. The sum of L_{int} of the USB peripheral device and L_{cable} of the associated cable shall be less than or equal to L_a ($L_{int} + L_{cable} \leq L_a$).

Application Information

Per the National Electrical Code, the circuit parameters of associated field wired apparatus for use in hazardous locations shall be coordinated with the host product such that their combination remains nonincendive. The PanelView Plus or VersaView CE terminal, and the USB peripheral device shall be treated in this manner.

The circuit parameters of the PanelView Plus and VersaView CE USB ports are given in Table 1. The USB peripheral device and its associated cabling shall have circuit parameters with the limits given in Table 2 for them to remain nonincendive when used with the PanelView Plus and VersaView CE USB ports. If cable compliance and inductance are not known, use the following values from UL 913:

C_{cable} = 60 pF/ft
L_{cable} = 0.20 µH/ft

Wiring and Safety Guidelines

Use publication NFPA 70E, 'Electrical Safety Requirements for Employee Workplaces', IEC 60364 'Electrical Installations in Buildings' or other applicable wiring safety requirements for the country of installation when wiring the devices. In addition to the NFPA guidelines:

- Connect the device and other similar electronic equipment to its own branch circuit.
- Protect the input power by a fuse or circuit breaker rated at no more than 15 A.
- Route incoming power to the device by a separate path from the communication lines.
- Cross power and communication lines at right angles if they must cross. Communication lines can be installed in the same conduit as low level DC I/O lines (less than 10V).
- Shield and ground cables appropriately to avoid Electromagnetic Interference (EMI).

  Grounding minimizes noise from EMI and is a safety measure in electrical installations.

For more information on grounding recommendations, refer to the National Electrical Code published by the National Fire Protection Association of Boston.

For more information on terminal wiring and grounding applications, refer to publication 2711P-TD001. You can locate this publication in the literature library at www.rockwellautomation.com/literature.

European Communities (EC) Directive Compliance

If this product has the CE mark it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

This product is tested to meet the Council Directive 89/336/EC Electromagnetic Compatibility (EMC) by applying the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2 EMC - Generic Emission Standard, Part 2 - Industrial Environment
- EN 61000-6-2 EMC - Generic Immunity Standard, Part 2 - Industrial Environment

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 - Equipment Requirements and Tests. For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the Allen-Bradley publication Industrial Automation Wiring and Grounding Guidelines For Noise Immunity, publication 1770-4.1.

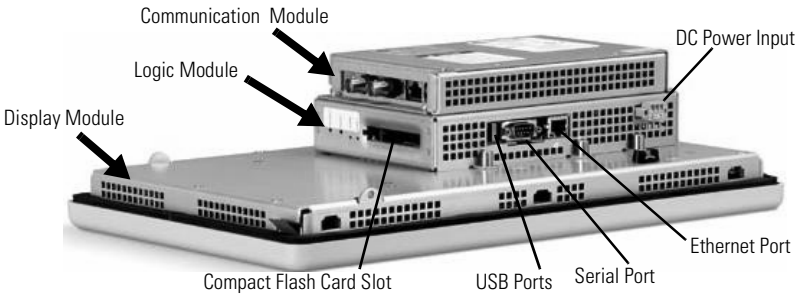
Open style devices must be provided with environmental and safety protection by proper mounting in enclosures designed for specific application conditions. See NEMA Standards publication 250 and IEC publication 529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.

About the Terminals

The terminals have these modular components:

- Display module (1250/1250H)
- Logic module (DC power, CF card slot, Ethernet port, Serial port, USB ports)
- Internal compact flash card with firmware or operating system, RAM memory (SO-DIMM)
- Communication module (for specific communication protocols)

High-Bright display modules are only available as separate components. Logic modules and communication modules must be ordered separately.



Attach the logic module and communication module to the display module before panel installation. See the instructions shipped with each module.

The logic module for the terminals is available with or without RAM and compact flash preinstalled. If memory is ordered separately, you must install the memory before attaching the logic module to the display module. See the instructions shipped with the logic module.

Before You Begin

Parts List

The terminals ship with:

- Power terminal block
- Mounting clips
- RSView Machine Edition preloaded
- Installation instructions and panel cutout template

Required Tools

Tools required for installation are:

- Panel cutout tools
- Small, slotted screw driver
- Torque wrench (in-lb)

Install the Terminal

Before installing the terminal in a panel, review:

- Environmental considerations
- Enclosures and outdoor installation
- Mounting clearances
- Panel cutout dimensions
- Product dimensions

Environmental Considerations

The terminals are suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution Degree 2)(1) and with circuits not exceeding Over Voltage Category II (2) (IEC 60664-1).(3)

(1) Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.

(2) Over Voltage Category II is the load level section of the electrical distribution system. At this level transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.

(3) Pollution Degree 2 and Over Voltage Category II are International Electrotechnical Commission (IEC) designations.

Enclosures

The terminals must be mounted in a panel or enclosure to protect the internal circuitry. The terminals meet NEMA Type 12/13 and 4X ratings only when mounted in a panel or enclosure with the equivalent rating.

See the Outdoor Installation section for additional enclosure and certification information on the High-Bright display modules.

When the terminal is not mounted in a panel, it is not secure or safe for operation. You must comply with the NEMA Type 4 requirements for environmental specifications.

Outdoor Installation

When using the High-Bright display module outdoors, important considerations in maximizing the field life of the front bezel and display are:

- Selecting the proper enclosure
- Orientation of the terminal

Both ultraviolet and infrared radiation can reduce the field life of any electronic device. While the materials used in the PanelView Plus and VersaView CE bezels provide long field life, that life can be improved by proper installation.

Ultraviolet radiation from the sun causes all plastics to fade or yellow and become brittle over time. Using an antiglare overlay, cat. no. 2711P-RGT12, will protect the front of the terminal from direct exposure to UV radiation and greatly increase its field life.

When installing the High-Bright display module in an environment where the front of the terminal will be in direct sunlight during the hottest part of the day and the external ambient temperature can exceed 40 °C (104 °F), use the visor kit, cat. no. 2711P-RVT12. The visor reduces the solar load on the front of the display and helps to maintain internal temperatures within specification.

The High-Bright display module has a built in temperature sensor that automatically reduces the backlight intensity if the temperature inside the cabinet exceeds 55 °C. This reduces the risk of damage to the display.

The paint color, size, and power dissipated by the internal components of an enclosure affect the temperature rise inside the cabinet. Hoffman, a Rockwell Automation Encompass Partner, has information to assist you with enclosure selection and heating/cooling accessories to meet the temperature requirements of the installed equipment. See website http://www.hoffmanonline.com.

Stirring fans or active cooling may be required in high altitude and high ambient temperature locations to keep the internal enclosure temperature below 55 °C (131 °F). Use a heater in installations where the ambient temperature is below 0 °C (32 °F).

The backlight of the High-Bright display generates a significant amount of heat when set to full intensity. To minimize the amount of heat generated and extend the life of the backlight, decrease the display intensity by using the screen saver with a 5 to 10 minute delay.

Avoid placing the terminal on the south (north in the southern hemisphere) or west side of the cabinet, if possible. This will reduce the heat rise due to solar loading during the hottest part of the day.

Mount the terminal vertically to minimize solar loading on the display. Do not mount the terminal in a sloped enclosure if it will be exposed to direct sunlight.

Mounting Clearances

Allow adequate clearance around the terminal, inside the enclosure, for adequate ventilation. Consider heat produced by other devices in the enclosure. The ambient temperature around the terminals must be between 0 to 55 °C (32 to 131 °F).

Minimum clearances for ventilation are:

- Top clearance: 51 mm (2 in)
- Bottom clearance: 102 mm (4 in)
- Side clearances: 25 mm (1 in)
- Back clearance: 25 mm (1 in)

Minimum side clearance for insertion of memory card is 102 mm (4 in).

Panel Cutout Dimensions

The table lists the panel cutout dimensions for the terminal. Use the full size template shipped with your terminal to mark the cutout dimensions.

PanelView Plus and VersaView CE Terminals	Height mm (in)	Width mm (in)
1250/1250H Touch	257 (10.11)	338 (13.29)

Mount the Terminal in a Panel

Four mounting clips secure the terminal to the panel.

ATTENTION

Disconnect all electrical power from the panel before making the panel cutout.

Make sure the area around the panel cutout is clear.

Take precautions so metal cuttings do not enter any components already installed in the panel.

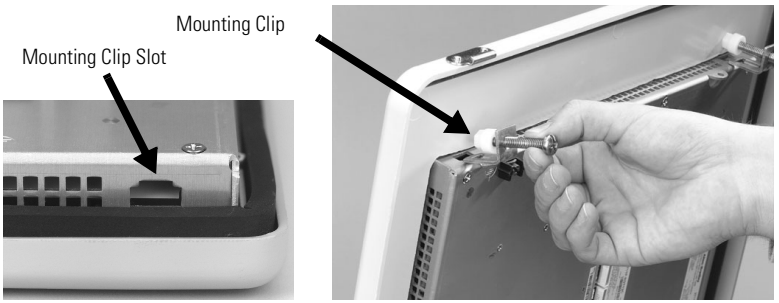
Failure to follow these instructions may result in personal injury or damage to panel components.

1. Cut an opening in the panel using the panel cutout shipped with the terminal.
2. Make sure the terminal sealing gasket is properly positioned on the terminal.

This gasket forms a compression type seal. Do not use sealing compounds.

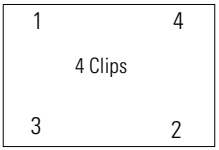
3. Place the terminal in the panel cutout.

4. Slide the ends of the mounting clips into the slots on the terminal.



5. Tighten the mounting clip screws by hand until the gasket seal contacts the mounting surface uniformly.

6. Tighten the mounting clip screws to a torque of 0.90 to 1.1 Nm (8 to 10 in-lb) using the specified torque sequence. Do not over-tighten.



ATTENTION

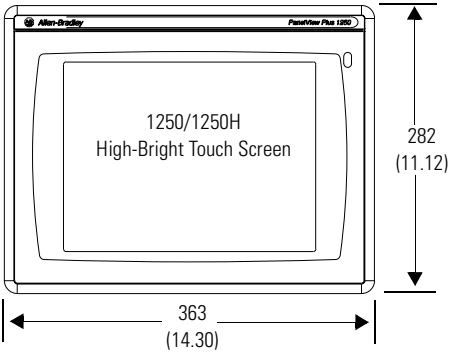
Tighten the mounting clips to the specified torque to provide a proper seal and prevent damage to the product. Rockwell Automation assumes no responsibility for water or chemical damage to the monitor or other equipment within the enclosure because of improper installation.

Product Dimensions

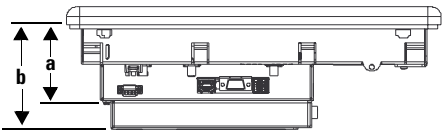
The illustration shows product dimensions for the touch screen terminals with the High-Bright display module. Depth dimensions are shown for:

- Base configured unit (display module and logic module)
- Base configured unit with communication module

Measurements are in mm (in).



a 74 (2.90) Display to Logic Module
b 101 (3.99) Display to Communication Module



Remove and Install the Power Terminal Block

You can remove and reinstall the power terminal block for ease of installation, wiring, and maintenance. The terminals ship with the power block installed.

WARNING

Explosion Hazard

Substitution of components may impair suitability for hazardous locations.

Do not disconnect equipment unless power has been switched off and area is known to be non-hazardous.

Do not connect or disconnect components unless power has been switched off.

All wiring must comply with N.E.C. articles 501, 502, 503, and/or C.E.C. section 18-1J2 as appropriate.

Peripheral equipment must be suitable for the location it is used in.

ATTENTION

Disconnect all power before installing or replacing components. Failure to disconnect power may result in electrical shock and/or damage to the terminal.

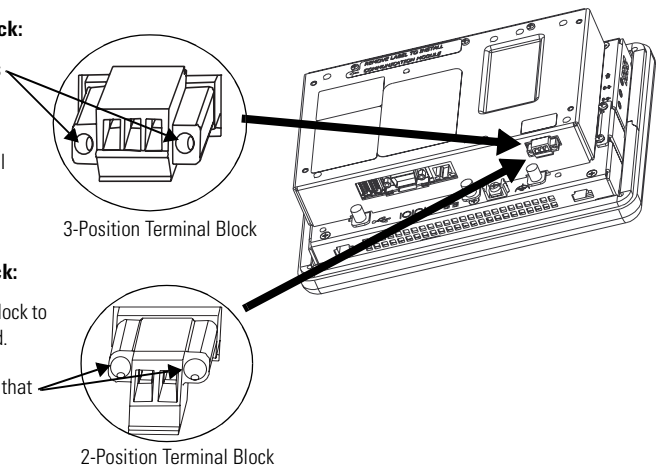
- Series A-D logic modules use a 3-position terminal block.
- Series E or later logic modules use a 2-position terminal block.

To remove terminal block:

1. Loosen the two screws that secure the terminal block.
2. Gently pull the terminal block away from the connector.

To install terminal block:

1. Reattach the terminal block to the connector until seated.
2. Tighten the two screws that secure the terminal block to the connector.



DC Power Connections

Terminals that operate on 24V dc power are EN 61131-2 Equipment Class II devices. These terminals have an integrated, non-isolated, 24V dc power supply. The electrical input ratings are:

- 24V dc nominal (18 to 32V dc)
- 70 W maximum (2.9A @ 24V dc)

The power supply is internally protected against reverse polarity of the + and - connections. Connecting the DC positive (+) or DC negative (-) source to the Functional Earth (FE) may damage the terminal.

The input power terminal block on the integrated power supply is removable and supports these wire sizes.

Terminal	Wire Type	Dual Wire Gauge (1)	Single Wire Gauge	Terminal Screw Torque
700-1500 Logic Module Series A-D	Stranded or solid	#22…#16 AWG	#22…#14 AWG	0.23…0.34 Nm (2…3 in-lbs)
700-1500 Logic Module Series E or later	Stranded or solid	#22…#16 AWG	#22…#14 AWG	0.45…0.56 Nm (4…5 in-lbs)

(1) Two-wire maximum per terminal

The non-isolated power supply does not provide galvanic isolation. A Class 2 Safety Extra-Low Voltage (SELV) isolated power supply with a 24V dc nominal output voltage is required to power the terminal.

ATTENTION

Use a Class 2 SELV isolated and ungrounded power supply as input power to the terminal. This power source provides protection so that under normal and single fault conditions, the voltage between conductors and between conductors and Functional Earth or Protective Earth does not exceed a safe value.

Functional Earth Ground

DC powered terminals have a Functional Earth (FE) terminal which you must connect to a low impedance earth ground. This connection is required for Electromagnetic Compliance (EMC) with the European Union (EU) EMC directive for CE-mark conformance.

The terminals have the Functional Earth ground connection on the rear of the display module.

The Functional Earth terminal wiring requires a minimum wire gauge.

Wire Type	Wire Gauge	Terminal Screw Torque
Stranded or solid	#14 …#10 AWG	1.13…1.36 Nm (10…12 in-lbs)

The Functional Earth terminal may be internally connected to the DC negative (- DC) terminal within the PanelView Plus or VersaView CE terminal.

ATTENTION

A ground loop can occur when a voltage potential exists between two separate ground points. Make sure that the terminal does not serve as a conductive path between ground points at different potentials.

Use a single dedicated 24V dc source (power supply) to power each terminal, such as cat. no. 2711P-RSACDIN. Using a separate, isolated and ungrounded SELV source to power each terminal, prevents ground loop currents from damaging the terminals.

The terminals contain isolated and non-isolated communication ports.

For more information on wiring and grounding, refer to publication 2711P-TD001 available at www.rockwellautomation.com/literature.

Connect DC Power

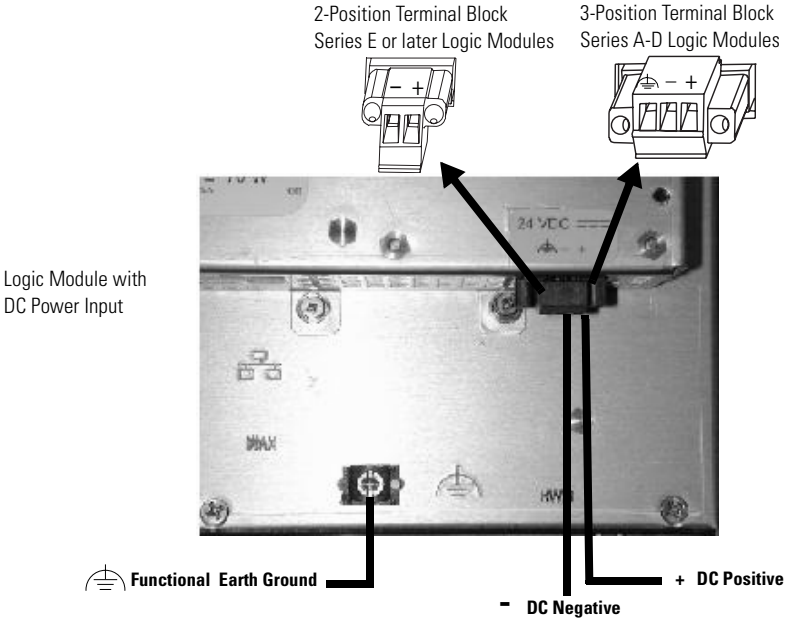
WARNING

Explosion Hazard - Do not connect or disconnect equipment while circuit is live unless area is known to be non-hazardous.

Disconnect all power before installing or replacing components. Failure to disconnect power may result in electrical shock and/or damage to the terminal.

1. Disconnect power to the terminal.
2. Secure the dc power wires to the terminal block screws.

   Follow the markings on terminal blocks and terminal for proper connections.
3. Secure the Functional Earth ground wire to the Functional Earth ground terminal screw at the bottom of the display.



4. Apply 24V dc power to the terminal.

Troubleshooting

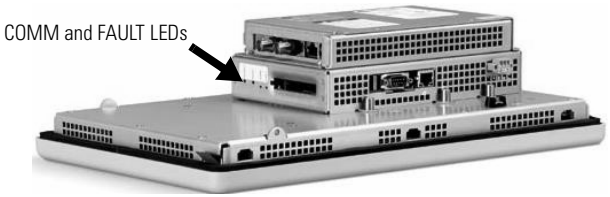
Check for Adequate Power

A terminal that does not receive adequate power could cause unpredictable behavior. Verify the power requirements in the Specifications table.

Check LED Indicators

The terminal has two LED indicators to isolate operating problems.

- COMM indicator (green) for communications
- FAULT indicator (red) for hardware faults



When the terminal starts up, the red LED indicator should be off, except for a few brief flashes, and the green LED should be on. If the indicators remain off, the power supply or logic module has failed. Replace the logic module if the power is within range; if not, replace the power supply. After a successful startup, both indicators are off and controlled by the application running on the terminal.

The table shows the state of the indicators if the terminal powers up and stops during startup.

Red LED	Green LED	Indication
Blinking red LED indicates a recoverable error.		
Blinking	Off	Last firmware download failed. Reload firmware using Firmware Upgrade Wizard (FUW) utility.
Blinking	Blinking	EBC boot loader firmware failed or is missing. Reload firmware using Firmware Upgrade Wizard (FUW) utility.
Blinking	On	Windows CE OS firmware failed or is missing. Reload firmware using Firmware Upgrade Wizard (FUW) utility.
Solid red LED indicates a nonrecoverable or fatal error.		
On	Off	Fatal hardware error occurred. Replace the logic module.
On	Blinking	Fatal hardware error occurred in Display. Replace the display module.

Check Display Problems

If the terminal display is dim or unreadable:

- Check the brightness setting of the display. From terminal Configuration Mode, access Terminal Settings>Display Intensity.
- Check the Screen Saver settings. The backlight may be turning off or dimming the display unexpectedly. From terminal Configuration Mode, access Terminal Settings>Display>Screen Saver.

Startup Information Messages

The table provides a list of system information messages that display at startup. The messages are in the order that they appear on the terminal screen during startup and typically display for a few seconds. Startup information messages show the startup sequence of the terminal but do not require that you perform any action.

Message #	Message	Description
37	Video Initialized	Configures and initializes the graphics video system.
30	Watchdog Test	Tests the watchdog circuitry to verify system integrity.
1	RAM Test	Tests the RAM memory.
31	Stuck Key	Checks the integrity of the function key hardware.
31.5	Stuck Touch	Checks the integrity of the touch screen hardware.
32	Battery Test	Checks the integrity of the battery hardware.
2.5	Registry Search	Locates and loads the most recent, valid registry. Multiple copies of the registry are maintained. If power is lost during a registry update, a valid registry is available the next time power is applied to the terminal.
2	Image Search	Checks for a new OS firmware upgrade on the external compact flash card and the serial port.
50	External CF	Transfers a new OS firmware upgrade from the external compact flash card to the terminal. Message may display for several minutes.
23	Internal CF	Programs the OS firmware just downloaded into the internal flash memory. Message may display for several minutes.
24	CRC Check	Checks the integrity of the OS firmware.
28	Starting System	Launches the operating system (OS).
29	System Check ###	Internal file system integrity check (### is percent progress indicator).
29.1	System Check	Internal file system integrity check disabled. Contact technical support.

Startup Error Messages

The table provides a list of system error messages that may display on startup and the recommended corrective action. When an error occurs, the terminal displays an error number with a text message. The word ERROR! appears under this line in different languages.

Displayed Message
ERROR! FEHLER! ERREUR! ERRORE!

Error #	Message	Description	Recommended Corrective Action
1	RAM Test	RAM test failure	Reset the terminal. If error persists, reseat the SO-DIMM RAM module. If error still persists, replace the logic module.
23	Internal CF	Error programming the new OS firmware to internal compact flash.	Reload the firmware. If error persists, replace the internal compact flash. If error still persists, replace the logic module.
24	CRC Check	Checksum of the OS firmware failed.	Reload the firmware. If error persists, replace the internal compact flash card. If error still persists, replace the logic module.
30	Watchdog Test	Watchdog test failure	Reload the firmware. If error persists, replace the logic module.
31	Stuck Key	Function key failure	Check that nothing is pressed against a key. Reset the terminal without key presses. If error persists, replace the display module.
31.5	Stuck Touch	Touch screen failure	Check that nothing is pressed against the touch screen. Reset the terminal without pressing the touch screen. If error persists, replace the display module.
32	Battery Test	Battery failure	Replace the battery. If error persists, replace the logic module.
33.5	NVRAM Access	Non-volatile memory failure.	Upgrade the system firmware to revision 3.10.03 or later.
40	EXE Check	System OS firmware is missing or corrupt.	Reload the firmware. If error persists, replace the internal compact flash card. If error still persists, replace the logic module.
50	External CF	Error loading the OS firmware from the external compact flash card	Reload the firmware. If error persists, replace the external compact flash card and attempt the firmware upgrade again.

Specifications

PanelView Plus and VersaView CE Terminals - cat. nos. 2711P-RDT12H and 6182H-RDT12H

Specification	Value
Display	
Display Type	Color Active Matrix, Thin Film Transistor (TFT), with Liquid Crystal Display (LCD)
Display Size	12.1 in
Display Area (W x H)	246 x 184 mm (9.7 in x 7.2 in)
Display Resolution	800 x 600
Luminance	1000 cd/m^2 (Nits)
Backlight	Not replaceable
Touch Screen	Analog resistive
Electrical	
Input Voltage DC	24V dc nom (18…32V dc)
Power Consumption DC	70 W max (2.9 A @24V dc)
Mechanical	
Dimensions (HxWxD) for based configured unit without communication module	
1250/1250H High-Bright Touch	282 x 363 x 74 mm (11.12 x 14.30 x 2.90 in)
Weight for base configured unit without communication module	
1250/1250H High-Bright Touch	3.2 kg (7.1 lb)
General	
Battery Life	4 years at 25 °C min
Clock	Battery-backed, + /- 2 minutes per month
LED Indicators	COMM (Green), Fault (Red)
Application Flash Memory	12 MB
External Compact Flash Storage	512 MB max

Environmental Specifications

Specification	Value
Operating Temperature	0…55 °C (32…131 °F)
Storage Temperature	-20…70 °C (-13…158 °F)

Environmental Specifications

Vibration	10…57 Hz, 0.012 pk-pk displacement 57…500 Hz 2.0 g pk acceleration
Shock Operating	15 g at 11 ms
Shock Non-Operating	30 g at 11 ms
Relative Humidity	5…95% without condensation
Enclosure Ratings	NEMA Type 12, 13, 4X (indoor use only), IP54, IP65

Certifications

Certification
UL Listed Industrial Control Equipment UL Listed Industrial Control Equipment for use in Canada UL Listed Industrial Control Equipment for use in: • Class I, Div 2, Group A, B, C, D • Class 1 Zone 2, Group IIC • Class II, Div 2 Groups F, G • Class III, Div 1 Hazardous Locations
CE marked for all applicable directives
C-Tick

Additional Resources

For additional information on the terminals, refer to these publications.

Publication	Publication Number
PanelView Plus User Manual	2711P-UM001
VersaView CE User Manual	6182H-UM001
Wiring and Grounding Applications	2711P-TD001

You can also download these publications from the Rockwell Automation website.

http://www.rockwellautomation.com/literature

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UNIVERSAL REMOTE I/O LINK OVERVIEW

Universal Remote I/O Link Overview

The Allen-Bradley Universal Remote I/O Link connects the PLC and SLC processors to remote I/O chassis and a host of intelligent devices such as operator interfaces and ac and dc drives.

In addition to I/O, Allen-Bradley operator interfaces, ac and dc drive systems, intelligent sensing products, Computer Numerical Controllers (CNCs), and other devices are compatible with this link. Some products, such as PanelView Operator Terminals, have built in "adapter" capability, while other products, such as the 1336 drives, require optional "adapter" modules to put them on the link. Some products are installed in the 1771 I/O chassis and communicate over the chassis backplane to a Remote I/O Adapter, which communicates to the programmable controller's scanner. In addition, the 1784-PKTS communication interface card lets an ISA/EISA bus PC communicate directly with Allen-Bradley remote I/O devices.

Other companies offer products such as robotic and welding controllers, scales, and wireless modems that are compatible with the Universal Remote I/O Link as well. In total, there are approximately 100 devices available that can communicate on this link. By using these devices on the link, the user can speed up communication and allow the devices to work together to help improve quality while lowering integration, maintenance, and training costs.

For distributed processing, put a PLC-5 processor in "adapter mode" and install it in an I/O chassis where it can monitor its own resident I/O while communicating to a supervisory PLC-5 processor over the Universal Remote I/O Link. SLC processors can also be distributed on the link where they can control I/O while communicating with a supervisory processor via a 1747 Direct Communication Module.

For high-speed processing applications, an extended-local I/O link is available, which provides a parallel I/O link (the practical equivalent of processor-resident-chassis performance for I/O modules not placed in the processor's chassis). In addition, the Allen-Bradley ControlNet network, which provides deterministic, repeatable transfers of control data, is suitable for real-time, high-throughput applications.

Benefits

- Uses transceivers communicating over a single channel.
- Uses standard PVC twinaxial cable (cat. no. 1770-CD) as the transmission medium.
- Uses a daisy-chain connection with a maximum length of 3,048m (10,000 ft).
- Operates at the data rates listed in Specifications. A 1/2-watt terminating resistor is required at each end of the trunk line to eliminate reflections. Error checking is done using standard CRC16 checks.
- Is based on the master/slave model. The controller's scanner is the master and the I/O chassis or adapter devices are slaves. The slave only responds when told to by the master.
- Provides transfer of a single unit (8, 16, or 32 bits) of I/O image data to/from each I/O module in each I/O chassis during each I/O scan. The size of the unit depends on the I/O addressing density

selected at the I/O chassis. It can also provide block transfers of 64 words maximum to an individual I/O module (except when used with the 1747-SN).

- Lets Remote I/O Scanners connect to a maximum of 32 I/O chassis or other adapter-type devices on a single link. Devices built to original Universal Remote I/O specifications are compatible with those built to the new specifications. However, if any of the devices on a link are built to the original specifications, the limit is 16 devices on a single link. In any case, for a specific scanner, the number of adapter-type devices is limited by the I/O rack addressing capability of the scanner.

Universal Remote I/O Specifications

Communication Rate	Distance meters (ft)	Termination Resistor
57.6 kbit/s	3,048 (10,000)	150Ω 1/2W or 82.5Ω 1/2W
115.2 kbit/s	1,524 (5,000)	150Ω 1/2W or 82.5Ω 1/2W
230.4 kbit/s	762 (2,500)	82.5Ω 1/2W

Compatibility

The strength and versatility of the Universal Remote I/O link come from the breadth of products it supports. In addition to 1771 I/O, the industry's largest I/O offering, a variety of devices can be connected to the Remote I/O Link.

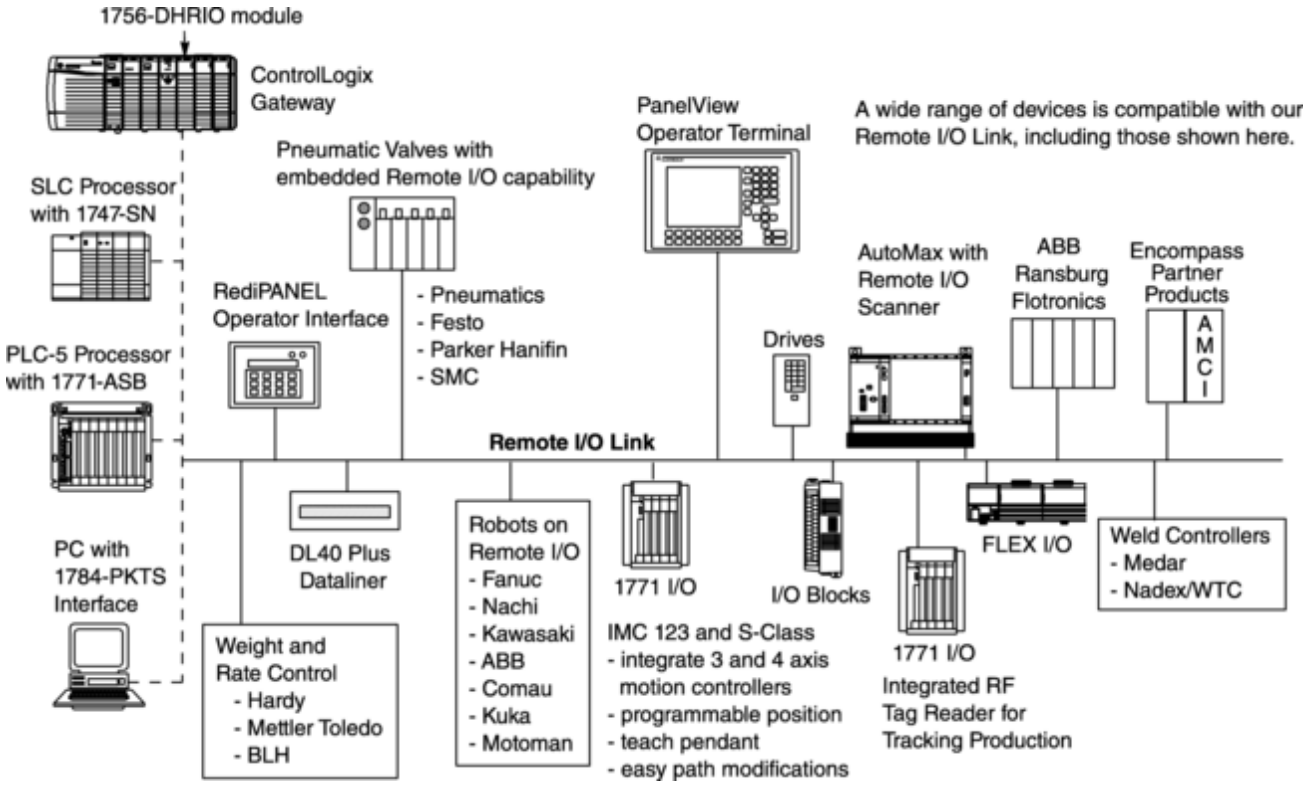
Scanners	Adapters	MMI	Input Devices	Output Devices
• PLC-5/xx, • 1747-SN • AutoMax® Allen-Bradley Remote I/O Scanner M/N 57C443	• 1771-ASB • 1747-ASB • 1791-Block • 1794-ASB • 1794-ASB2 • 1747-DCM	• RediPANEL • PanelView • Dataliner	• RF tag readers✶ • Weigh scales✶ • Vibration	• S Class Creonics • 1336,1395 Drives • 9/SERIES CNC • Welders, Robots✶ • Pneumatic valve packs✶ • Voice Annunciators✶

✶ Non-Allen-Bradley devices.

Typical Configurations

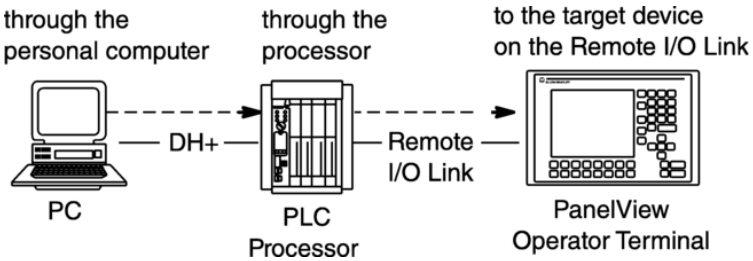
Typical configurations range from simple I/O links with PLC processors and I/O, to links with a variety of other Allen-Bradley and third-party devices. When drives and other devices, including third-party devices are to be included in a controller system, the Universal Remote I/O link provides the means to do that though remote I/O adapter modules and built-in remote I/O adapters.

Using the Universal Remote I/O Link instead of direct wiring a long distance to a local I/O chassis helps reduce installation, start-up, and maintenance costs by placing the I/O chassis closer to the sensors and actuators. To install a Universal Remote I/O Link between buildings or in high-noise areas, such as next to arc welders, use Allen-Bradley fiber-optic repeaters (cat. nos. 1771-AF, -AF1).



Pass-Through over Universal Remote I/O

Certain products, such as IMC™ controls, PanelView Operator Terminals, and Dataliner Message Displays, support "Pass-Through." This capability lets you configure devices remotely over the Data Highway Plus and Remote I/O links. Note the illustration below, it shows a PanelView configuration file, originally generated using PanelBuilder software on a personal computer, being passed through to a PanelView Operator Terminal.



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GENERAL MONITORS

Model S4000C

Intelligent Sensor for Combustible Gas Detection

The information and technical data disclosed in this document may be used and disseminated only for the purposes and to the extent specifically authorized in writing by General Monitors.

Instruction Manual **0307**

General Monitors reserves the right to change published specifications and designs without prior notice.

Part No. **MANS4000C**
Revision **G/03-07**

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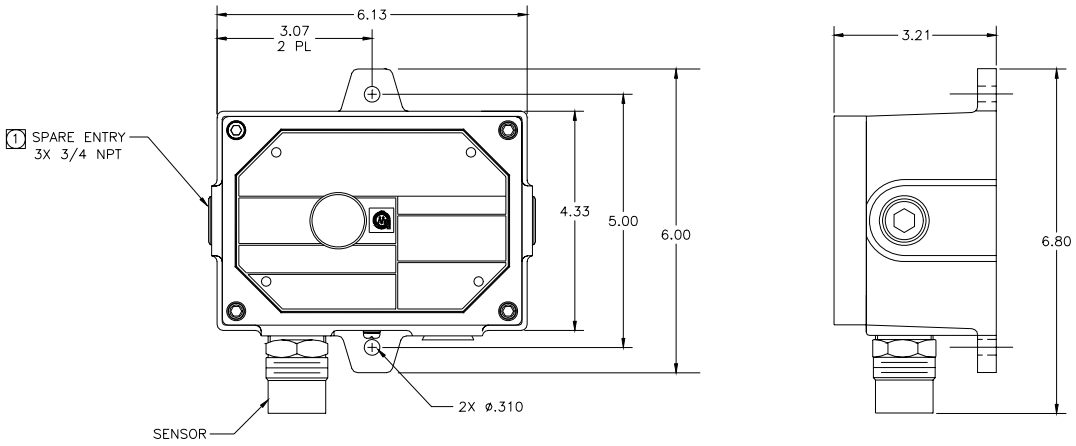
Quick Start Guide

Mounting and Wiring

Tools Required

1. “5mm” Allen head wrench to remove enclosure lid (included with gas detector).
2. Flat-head screwdriver maximum 3/16” (5 mm) width for terminal block connections (included with gas detector).
3. Adjustable wrench for conduit or cable gland connections (not included).

It is not necessary to seal the Model S4000C housing to maintain its explosion-proof integrity; however, conduit runs containing wires attached to the Model S4000C’s relay contacts must be sealed.



Information on Class I location seals can be found in the NEC, Article 501-5.

Figure 1: Outline and Mounting Dimensions

Terminal Connections

The terminal blocks (TB) are located inside the housing and can be accessed by removing the cover. A label on the inside of the housing cover provides details of all the terminal connections.

WARNING: Do not connect +24VDC to TB1. Damage to the electronics, or sensor may result.

It is recommended that a three-wire (red, black, white) shielded cable be used for making power and output signal connections on the Model S4000C. The Spring Type terminal block accepts 14 AWG to 20 AWG and the Screw Type terminal block accepts 12 AWG to 18 AWG stranded or solid wire. Each wire should be stripped before wiring the Model S4000C Intelligent Sensor. To connect wiring to the Spring Type terminal block, insert a screwdriver into the orange tab and press down (Figure 2), opening the terminal. Insert the wire into the terminal

and release the orange tab, clamping the wire in the terminal. Check the hold of the wire by GENTLY tugging it to ensure it is locked in.

To connect wiring to the Screw Type terminal block, (Figure 3) use a screwdriver to loosen the top screw counter clock wise. Insert the wire into the terminal and tighten the top screw clock wise. Check the hold of the wire by GENTLY tugging it to ensure it is locked in.

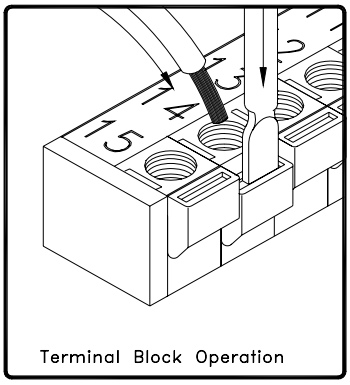


Figure 2: Spring Type Terminal Block Operation

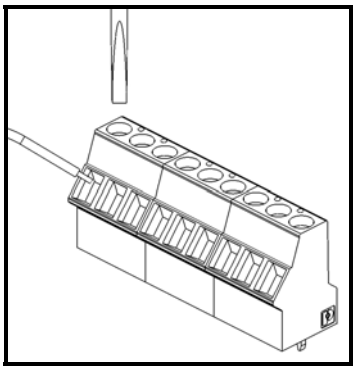


Figure 3: Screw Type Terminal Block Operation

NOTE: Power must remain disconnected until all other wiring connections have been made.

The maximum distance between the Model S4000C and the power supply is 3430 feet or 1040 meters (each cable run should be as short as possible). See Section 9.3.3 for cable length specifications. Connect +24VDC to TB2, position 9. Connect the ground or common to TB2, position 8.

The instrument is now ready to operate. Please consult the manual for more information on the instrument's many features.

NOTE: If you have any problems in the set-up or testing of the detector, please refer to the "Trouble Shooting Section", or call the factory direct.

Worldwide service is available by calling:

Lake Forest, California (24 hr. service)	Toll Free: +1-800-446-4872 Phone: +1-949-581-4464 Fax: +1-949-581-1151
Houston, Texas	Phone: +1-281-855-6000 Fax: +1-281-855-3290
Ireland	Phone: +353-91-751175 Fax: +353-91-751317
Singapore	Phone: +65-6748-3488 Fax: +65-6748-1911
United Arab Emirates	Phone: +971-4-8815751 Fax: +971-4-8817927
United Kingdom	Phone: +44-1625-619583 Fax: +44-1625-619098

1.0 Introduction

1.1 Protection for Life

General Monitors' mission is to benefit society by providing solutions through industry leading safety products, services, and systems that save lives and protect capital resources from the dangers of hazardous flames, gases, and vapors.

This manual provides instruction for installing and operating General Monitors' Model S4000C for Combustible Gas Detection. While the S4000C is easy to install and operate, this manual should be read in full and the information contained herein understood before attempting to place the system in service.

The safety products you have purchased should be handled carefully and installed, calibrated, and maintained in accordance with the respective product instruction manual. Remember these products are for your safety.

1.2 Special Warnings

The Model S4000C Intelligent Sensor contains components, which can be damaged by static electricity. Special care must be taken when wiring the system to ensure that only the connection points are touched.

Toxic, combustible and flammable gases and vapors are very dangerous. Extreme caution should be used when these hazards are present.

1.3 System Integrity Verification

Commissioning Safety Systems

Before power up, verify wiring, terminal connections and stability of mounting for all integral safety equipment including, but not limited to:

- Power supplies
- Control modules
- Field detection devices
- Signaling / output devices
- Accessories connected to field and signaling devices

After the initial application of power (and any factory specified warm-up period) to the safety system, verify that all signal outputs, to and from devices and modules, are within the manufacturers' specifications. Initial testing should be performed per the manufacturers' recommendations and instructions.

Proper system operation should be verified by performing a full, functional test of all component devices of the safety system, ensuring that the proper levels of alarming occur. Fault/Malfunction circuit operation should be verified.

Periodic Testing of Field Devices

Periodic testing/calibrating should be performed per the manufacturer's recommendations and instructions. Testing/Calibrating procedures should include, but not be limited to:

- Verify integrity of all optical surfaces and devices
- For flame detectors, use the appropriate test lamp

When testing produces results outside of the manufacturer's specifications, replacement of the suspect device(s) should be performed as necessary. Maintenance intervals should be independently established through a documented procedure, including a maintenance log maintained by plant personnel or third party testing services.

Periodic System Verification

The following system verifications should be performed at least annually:

Verify wiring, terminal connections and stability of mounting for all integral safety equipment including, but not limited to:

- Power supplies
- Control modules
- Field detection devices
- Signaling / output devices
- Accessories connected to field and signaling devices

2.0 Product Description

2.1 General Description

The Model S4000C is an intelligent sensor for the detection of combustible gases and vapors. The microprocessor-based electronics processes information at the sensor site, within an explosion-proof housing.

A digital display provides indications and display codes that can be viewed through a window in the cover. A red LED above the digital display signifies an ALARM condition, while a red LED below the digital display signifies a WARN condition. Analog signal (4-20mA) and optional Dual Redundant MODBUS communications and relays, provide remote and/or discrete indications of the sensor's operation.
The Model S4000C Intelligent Sensor is rated explosion-proof for use in the following hazardous areas:

- CSA/FM: Class I, Division 1, Groups B, C, D and Class I, Zone 1, Ex d IIB+H_2, T6
- ATEX: II 2 G EEx d IIB T5 (Tamb=-40°C to +70°C) EN 61779-1

INTELLIGENT SENSOR, COMBUSTIBLE GAS
MODEL S4000C
P/N 31140 –
GENERAL MONITORS
GALWAY, IRELAND
LAKE FOREST, CALIFORNIA, USA
EExd IIB T6 (Tamb = - 40° C to +40° C)
EExd IIB T5 (Tamb = - 40° C to +70° C)
Use cable with insulation rated to at least 110° C
S.C.S. Ex 98E1012X
RATED 24 VDC 7 W MAX. , CONTACT RATINGS : SEE MANUAL
CALIBRATION PROCEDURE
1 HAVE SENSOR IN CLEAN AIR
2 APPLY MAGNET AND WAIT FOR "AC" ON DISPLAY
3 WHEN DISPLAY STOPS FLASHING APPLY GAS AND WAIT FOR "CC" ON DISPLAY
4 REMOVE GAS
CLASS I, DIV. 1
GROUPS B, C & D
TYPE 4X
CAUTION: DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT. DO NOT OPEN WHILE ENERGIZED. READ AND UNDERSTAND INSTRUCTION MANUAL BEFORE OPERATING OR SERVICING.
COMBUSTIBLE GAS DETECTION INSTRUMENT
CERTIFIED - CSA Standard C22.2 NO.152
THIS INSTRUMENT EMPLOYS A FLAMMABLE GAS SENSOR COVERED BY:
CERTIFICATE
S/N
CONFIG
MAN

Figure 4: Model S4000C Intelligent Sensor

3.0 Installation

3.1 Receipt of Equipment

All equipment shipped by General Monitors is pre-packed in shock absorbing containers, which provide protection against physical damage (original containers should be kept for future shipping or storage needs).

Shipping container contents should be carefully removed and checked against the packing list. If any damage has occurred, or there is any discrepancy in the order, please notify General Monitors as soon as possible.

All correspondence with General Monitors must specify the equipment part number and serial number.

The factory tests each unit; however, a complete system checkout is suggested upon initial installation to ensure system integrity.

WARNING: Installation and Maintenance must be carried out by suitably skilled and competent personnel only.

3.2 Tools Required

1. “5 mm” Allen head wrench to remove enclosure lid (included with gas detector).
2. Flat-head screwdriver maximum 3/16” (5 mm) width for terminal block connections (included with gas detector).
3. Adjustable wrench for conduit or cable gland connections (not included).

3.3 Choosing Product Locations

There are no standard rules for sensor placement, since the optimum sensor location is different for each application. The customer must evaluate conditions at the facility to make this determination. Generally, the Model S4000C Intelligent Sensor should be easily accessible for calibration checks.

- The transmitter should be mounted pointing down to prevent water build-up on the sensor head.
- The transmitter should not be placed where contaminating substances may coat it.
- Although the Model S4000C is RFI resistant, it should not be mounted in close proximity to radio transmitters or similar equipment.
- Locate the Model S4000C where prevailing air currents contain the maximum concentration of gas.
- Locate the Model S4000C near possible sources of gas leaks.
- Observe the Model S4000C’s temperature specification and locate the unit away from concentrated sources of heat.

- Transmitters should be mounted in an area that is as free from wind, dust, water, shock, and vibration as possible. See Section 9.3.4 for the environmental specifications of the unit. If the sensor cannot be located away from dust and rain, then we recommend the use of our splash guard GM P/N 10395-1 to help protect the sensor.

Sensors may be adversely affected by prolonged exposure to certain materials. Loss of sensitivity or corrosion may be gradual if such materials are present in low concentrations, or it may be rapid at high concentrations. The more important materials adversely affecting sensors are:

- Constant presence of high concentrations of Hydrogen Sulfide (H_2S) gas
- Silicones (often contained in greases and aerosols)
- Halides, compounds containing Fluorine, Chlorine, Bromine and Iodine
- Heavy metals, e.g. Tetraethyl Lead
- Caustic and acidic liquids and vapors

The presence of poisons and contaminants in an area does not necessarily preclude the use of a Model S4000C Intelligent Sensor. The feasibility of using a sensor in such areas must be determined by an analysis of the specific factors in each application and General Monitors should be consulted before attempting any such installation.

Sensors used in these areas usually require more frequent calibration checks than normal, and typically have a shorter life. In many such applications, the standard two-year warranty would not apply.

WARNING: General Monitors discourages the painting of sensor assemblies. If the sensor head is painted over, the gas will not be able to diffuse into the sensor. If the assembly cover is painted over, the digital display cannot be read.

3.3.1 Remote Mounting of the Sensor from the Electronics

If it is necessary to remotely mount the sensor from the electronics and the housing, the maximum distance can be no greater than 7600 feet, using 14 AWG wire. Sensors that are remotely mounted must be placed in an explosion-proof rated sensor housing (GM P/N 10252-1), and the cable run must be contained in conduit running from the sensor housing to the electronics. See Section 9.7 for FMRC approval requirements.

3.4 Mounting and Wiring

WARNING: The conduit entries should be sealed per the NEC 500-3d or Canadian Electrical Code Handbook (Part 1, Section 18-154). Additional benefit of conduit seals is the prevention of water entering the housing through the conduit entry.

WARNING: Unused cable entry holes must be sealed with an approved explosion-proof stopping plug. Red caps supplied by General Monitors are for dust protection only, and must not be left on the unit when installed.

The overall and mounting dimensions for the Model S4000C (Figure 5) should be used when making installation determinations. A complete list of the mechanical specifications can be found in Section 9.3.2.

To prevent possible corrosion due to moisture or condensation, it is recommended that the conduit connected to the Model S4000C housing be sealed, or contain a drain loop. Each conduit run from a hazardous location to a non-hazardous location should be sealed so that gases, vapors, and/or flames cannot pass beyond the seal. The purpose of seals in a Class I hazardous location is to prevent the passage of gases, vapors, or flames from one electrical installation to another through the conduit system.

It is not necessary to seal the Model S4000C housing to maintain its explosion-proof integrity; however, conduit runs containing wires attached to the Model S4000C's relay contacts must be sealed (Section 3.5).

Information on Class I location seals can be found in the NEC, Article 501-5.

WARNING: Acetic acid will cause damage to metal components, metal hardware, ceramic IC's, etc. If damage results from the use of a sealant that outgases acetic acid (RTV silicone), the warranty will be void.

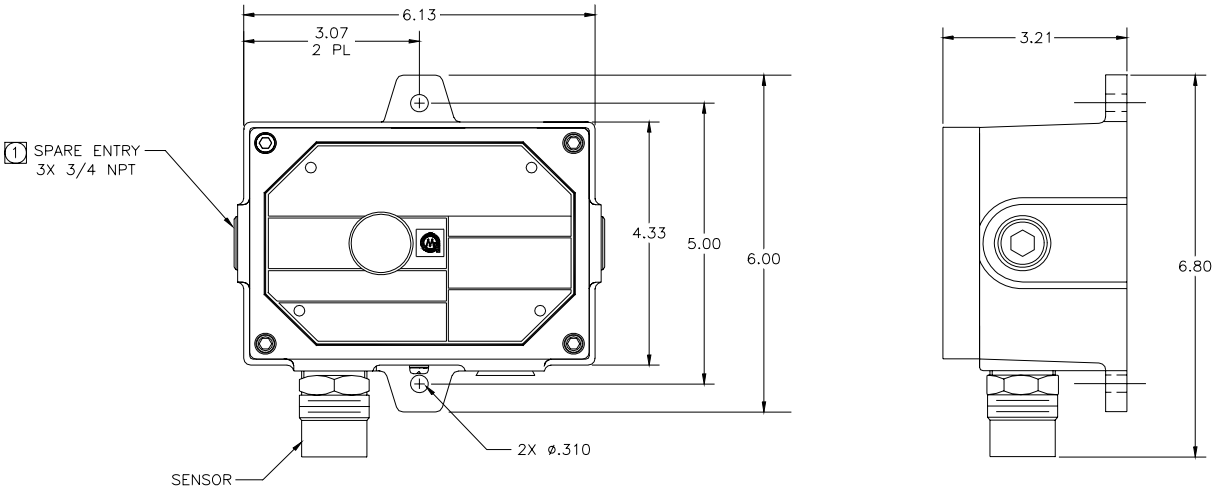


Figure 5: Outline and Mounting Dimensions

Once correctly installed, the Model S4000C requires little or no maintenance, other than periodic calibration checks to ensure system integrity. General Monitors recommends that a schedule be established and followed.

NOTE: The system's full two-year warranty will be voided if customer personnel or third parties damage the system during repair attempts.

Sensor heads exposed to the elements may require the accessory mounting threads to be lubricated. Grease must not be used. As an alternate, PTFE (Teflon) tape may be used on sensor accessory threads.

NOTE: Do not use any material or substance on threads that contact the sensor housing.

The removal of particulate matter from sensor accessories may be done through the use of an appropriate halogen-free solvent. Water or ethanol are examples of suitable solvents. The accessories should be thoroughly dried with compressed air, if necessary, before refitting to the sensor body.

3.5 Terminal Connections

The terminal blocks (TB) are located inside the housing and can by accessed by removing the cover. A label on the inside of the housing cover provides details of all the terminal connections.

3.5.1 Terminal Block TB1 – Sensor Connections

TB1 contains the three sensor connections, white (W), black (B), and red (R). Remove the display board by loosening the two captive screws on the board and lifting it straight up. Connect the color-coded wires from the combustible sensor to the matching colored terminals on TB1. The label on the inside of the cover can serve as a guide. Replace the display board by pressing it into place, and tightening the two captive screws.

WARNING: Do not connect +24VDC to TB1. Damage to the electronics may result.

3.5.2 Terminal Block TB2 – Power and Signal Connections

TB2 contains the connections for Power, Relay Reset, Remote Calibration, MODBUS and 0-20mA Output Signal. The terminal connections are as follows:

TB2 position	Function
1	0-20mA Output
2	CH1 MODBUS -
3	CH1 MODBUS +
4	CH2 MODBUS -
5	CH2 MODBUS +
6	Remote Calibration
7	Relay Reset
8	Ground
9	+24VDC Power

Table 1: TB2 Power and Signal Connections

It is recommended that a three-wire (red, black, white) shielded cable be used for making power and output signal connections on the Model S4000C. The Spring Type terminal block accepts 14 AWG to 20 AWG and the Screw Type terminal block accepts 12 AWG to 18 AWG stranded or solid wire. Each wire should be stripped before wiring the Model S4000C Intelligent Sensor. To connect wiring to the Spring Type terminal block, insert a screwdriver into the orange tab and press down (Figure 6), opening the terminal. Insert the wire into the terminal and release the orange tab, clamping the wire in the terminal. Check the hold of the wire by GENTLY tugging it to ensure it is locked in.

To connect wiring to the Screw Type terminal block, (Figure 7) use a screwdriver to loosen the top screw counter clock wise. Insert the wire into the terminal and tighten the top screw clock wise. Check the hold of the wire by GENTLY tugging it to ensure it is locked in.

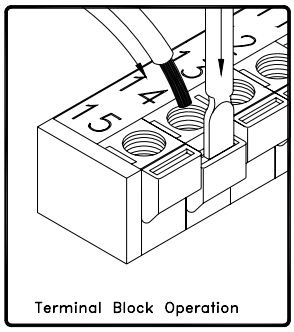


Figure 6: Spring Type Terminal Block Operation

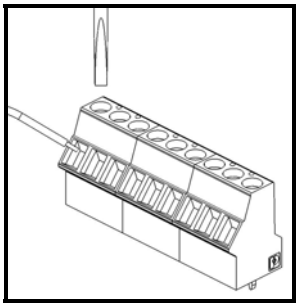


Figure 7: Screw Type Terminal Block Operation

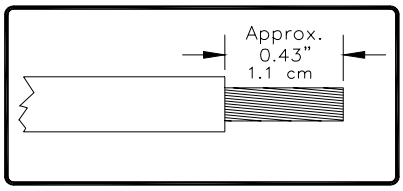


Figure 8: Wire Strip Length

NOTE: Up to 12 AWG wire can be used if it is carefully stripped (on a Screw Type terminal) (Figure 6).

3.5.3 DC Power and Ground Connections

The customer must provide primary DC power unless one of the following General Monitors Modules is being used with the Model S4000C:

- DC130 Dual-Channel Readout/Relay Display Module
- TA102A Trip Amplifier Module with a PS002 Power Supply & Relay Module

The following General Monitors Modules provide power connections for the Model S4000C, but need a customer supplied DC source:

- DC110 Eight-Channel Readout/Relay Display Module
- TA102A Trip Amplifier Module without a PS002

Since the Model S4000C is designed to operate continuously, a power switch is not included, in order to prevent accidental system shutdown.

NOTE: Power must remain disconnected until all other wiring connections have been made.

The maximum distance between the Model S4000C and the power supply is 3000 feet or 910 meters (each cable run should be as short as possible). See Section 9.3.3 for cable length specifications. To connect +24VDC to the Model S4000C, connect the red wire to TB2, position 9. Connect the black wire to TB2, position 8. For making power and ground connections to display devices see Table 2 and Table 3.

FROM	TO		
Model S4000C	Model DC110	Model DC130	Model TA102A
TB2-8 "COM"	Rear COMMON	Rear Pin 3 or 6 "COM"	Rear Pin 30d or 30z

Table 2: Ground or Common Connections

FROM	TO		
Model S4000C	Model DC110	Model DC130	Model TA102A
TB2-9 "+24 VDC"	Rear CH 1 – 8 24V	Rear Pin 4 or 7 "DC OUT"	Rear Pin 28d or 28z

Table 3: Power Connections

3.5.4 Analog Signal Connections

The Model S4000C Intelligent Sensor provides a 4 to 20mA output signal. It can be sent up to 9000 feet (2740 meters) to a General Monitors' readout/relay display module, or an industrial analog to digital converter, or a computer-based monitor, a PLC, a DCS, etc. The 4 to 20mA signal provides for control room or other locations remote to the Model S4000C to display indications of operation and alarm conditions. To connect the 4 to 20mA output signal with another unit, connect the wire into TB2, position 1, labeled 4-20mA OUT. For making output signal connections to display devices (Table 4), refer to the specific manual for that device.

FROM	TO			
Model S4000C	Model DC110	Model DC120	Model DC130	Model TA102A
TB2-1 4-20mA Output	Rear CH 1 – 8 4-20mA	Rear TB1 Pin 8 or 9	Rear Pin 2 or 5 Analog In	Rear Pin 26d or 26z

Table 4: Analog Signal Connections

If a device other than a General Monitors' readout/relay display module is being used, the DC ground, COM, of both systems must be connected together.

3.5.5 Terminal Block TB3 – Relay Connections

TB3 contains the connections for the Relay Contacts (optional). The function for the Warn and Alarm Relay connections vary according to the normal state of the relay. Use the following as a guide for determining the Normally Open (**NO**) and the Normally Closed (**NC**) contact:

TB3 position	Relay Contact (De-Energized)	Relay Contact (Energized)
1	Normally Closed	Normally Open
2	Common	Common
3	Normally Open	Normally Closed

Table 5: Alarm Relay Connections

TB3 position	Relay Contact (De-Energized)	Relay Contact (Energized)
4	Normally Closed	Normally Open
5	Common	Common
6	Normally Open	Normally Closed

Table 6: Warn Relay Connections

TB3 position	Relay Contact (Energized)
7	Normally Open
8	Common
9	Normally Closed

Table 7: Fault Relay Connections

***NOTE:** Fault relay is normally energized. Relay will change state after power up.

WARNING: Contact with PCB components should be avoided to prevent damage by static electricity. All wire connections are made to the Terminal Blocks.

WARNING: Relay contacts must be protected against transient and over voltage conditions (Figure 9).

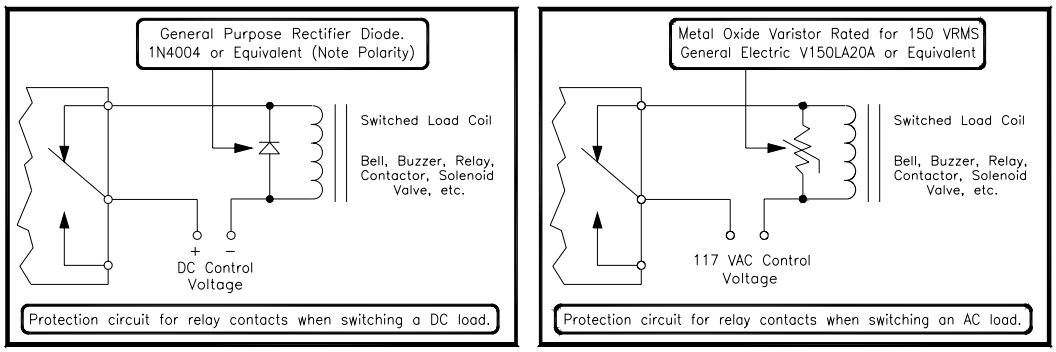

General Purpose Rectifier Diode.
1N4004 or Equivalent (Note Polarity)
Switched Load Coil
Bell, Buzzer, Relay, Contactor, Solenoid Valve, etc.
+
–
DC Control Voltage
Protection circuit for relay contacts when switching a DC load.
Metal Oxide Varistor Rated for 150 VRMS
General Electric V150LA20A or Equivalent
Switched Load Coil
Bell, Buzzer, Relay, Contactor, Solenoid Valve, etc.
117 VAC Control Voltage
Protection circuit for relay contacts when switching an AC load.

Figure 9: Relay Protection for DC and AC Loads

European Union (EU) Approved Applications: The ALARM relay contact ratings are 8A, 30 V RMS/42.4 V peak or 8A @ 30 VDC resistive max.

North American Approved Applications: The ALARM relay contact ratings are 8A @ 250 VAC and 8A @ 30 VDC resistive max.

3.5.6 European Union (EU) Approved Applications

Interconnecting cables must have an overall screen or screen and armor. Cables BS5308 Part 2, Type 2, or equivalent are suitable. Note that the terms 'screen' and 'shield' are equivalent for the purpose of this manual. The cable armor must be terminated in a suitable cable gland, at the detector, to ensure a positive electrical connection.

3.5.7 Cable Termination in the Non-Hazardous Area

- The cable **armor** must be connected to **safety earth** in the safe area.
- The cable **screen** (drain wire) must be connected to an **instrument earth** in the safe area.
- The power supply **OV return** must be connected to an **instrument earth** in the safe area.
- The interconnecting cables should be segregated from power and other noisy cables. Avoid proximity to cables associated with radio transmitters, welders, switch mode power supplies, inverters, battery chargers, ignition systems, generators, switch gear, arc lights and other high frequency or high power switching process equipment. In general, maintain separation of at least 1 meter between instrument and other cables. Greater separations are required where long parallel cable runs are unavoidable. Avoid running instrument cable trenches close to lightning conductor earthing pits.
- Complete all cable insulation testing before connecting the cable at either end.

WARNING: Under **NO** circumstances should equipment be connected or disconnected when under power. This is contrary to hazardous area regulations and may lead to serious damage to the equipment. Equipment damaged in this manner is not covered under warranty.

3.6 Maintaining the X/P Integrity

The Model S4000C Intelligent Sensor is rated explosion-proof for use in the following hazardous locations:

- CSA/FM: Class I, Division 1, Groups B, C, D and Class I, Zone 1, Ex d IIB+H_2, T6
- ATEX: II 2 G EEx d IIB T5 (Tamb=-40°C to +70°C) EN 61779-1

Some of the factors that influence the explosion-proof integrity of the Model S4000C housing are:

- Strength of the enclosure material
- Thickness of the enclosure walls
- Flame path between the housing and cover
- Flame path of threaded joints

The acceptable limits for explosion-proof housings that are used in Class I hazardous locations are defined in CSA Standard C22.2 No.30-M1986, FM 3615, and EN50014.

Anytime the cover of the Model S4000C housing is removed, or the cover bolts are loosened, the flame path between the lid and the housing is affected. If power is to be left on while removing the cover or loosening the cover bolts on the Model S4000C, it will be necessary to declassify the area.

When replacing the cover, the gap between the lid and the housing should be less than .0015 inch (.038 mm). Make sure that the flame-path is clear of dirt and debris before replacing the cover. This can be verified by tightening the cover bolts to a torque setting of 50 inch-pounds or by using a feeler gauge to ensure the gap between the cover and the housing is less than .0015 inch (.038 mm).

There are four entry holes, one each on the left and right sides, and two on the bottom of the Model S4000C housing. These holes are dedicated for the sensor, the reset switch and conduit. Each hole is tapped for ¾" NPT threads. If a particular entry hole is not used, it must be plugged during operation in the field. The factory installs plugs in the unused entry holes, except one. A red plastic cap is placed into the remaining hole and must be removed before conduit can be attached to the housing.

The Model S4000C will have the following items placed in the three remaining entry holes, at the factory:

- A sensor, if present (otherwise a red plastic cap)
- A reset switch, if present (otherwise an aluminum housing plug - optional)
- An aluminum-housing plug

The sensor, reset switch, and aluminum-housing plug have seven threads. Each of these components is screwed into the housing using five to seven turns. If it becomes necessary to replace the sensor, reset switch and/or the aluminum-housing plug, the user must use five to seven turns to ensure the explosion-proof integrity of the housing is maintained.

4.0 Operation

4.1 Start-Up Checklist

Prior to starting the system, verify the following:

1. Inhibit any external devices, such as Trip Amplifiers, PLC's, or DCS systems.
2. Verify that the optional settings are set for the desired configuration.
3. Verify that the unit is properly mounted. Ensure the conduit/cable gland entries are pointed downward.
4. Verify that the signal wiring is correct.
5. Verify that the power supply is connected properly. The Model S4000C is powered by +24VDC (20 to 36 VDC voltage range). The detector will output a low voltage (F6) fault at 18.5 VDC or below.
6. Make sure the lid is securely installed or the area has been declassified.

4.2 Start-Up

Before applying power to the system for the first time, all wiring connections should be checked for correctness and the housing cover replaced. Upon first power-up the sensor may take up to fifteen minutes to stabilize.

At the initial application of power, the unit will test all of the LED segments by displaying "**88.8**". The software revision letter will then be displayed for a few seconds. The unit will then enter a fifty second Start-Up mode. During this period, the display will read "**SU**". The unit will then enter Operational Mode, and the current gas concentration at the sensor will be displayed. For details of Calibrating and Gas Checking the unit, see Sections 4.5 and 4.6.

4.3 Relay Reset

If the Warn and Alarm relays are configured as latching, they must be manually reset, after an alarm occurs. This can be accomplished by three different methods:

1. The relays can be reset via the MODBUS Interface (Section 8.8.16).
2. The relays can be reset via the magnetic switch using a magnet. Place the magnet over the GM Logo on the cover of the unit. After three seconds, the display will show "rSt". Remove the magnet at this time and the relays will be reset (Figure 10).

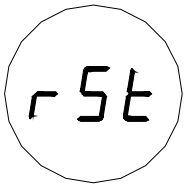


Figure 10: Relay Reset

3. The relays can be reset via the Remote Reset input terminals on TB2. Connect a normally open switch between terminal TB2-7 and TB2-8. Closing the switch momentarily will reset the relays. General Monitors explosion-proof switch, P/N 30051-1, can be used for this purpose. See Section 9.6 for ordering instructions.

NOTE: Red LED's above and below the digital display indicate that the Alarm and Warn relays are active. Latching relays can only be reset if the gas concentration has fallen below the respective relay set point.

4.4 User Selectable Options

The Model S4000C Intelligent Sensor includes many selectable options to provide the user with the most flexible combustible gas detector possible. These options include Adjustable Calibration Level, Warn and Alarm Relay Set Points and Configuration, and MODBUS Communications Settings. These allow the unit to operate with a wide variety of PLC and DCS Systems. The following sections explain the available options and how they can be customized.

A flow diagram is included to help the user in understanding the process of reviewing and changing the available options (Figure 11).

NOTE: If the unit was ordered without relays or MODBUS communications, changing relay or MODBUS settings will have no effect on the operation of the unit.

4.4.1 Model S4000C User Menu Structure

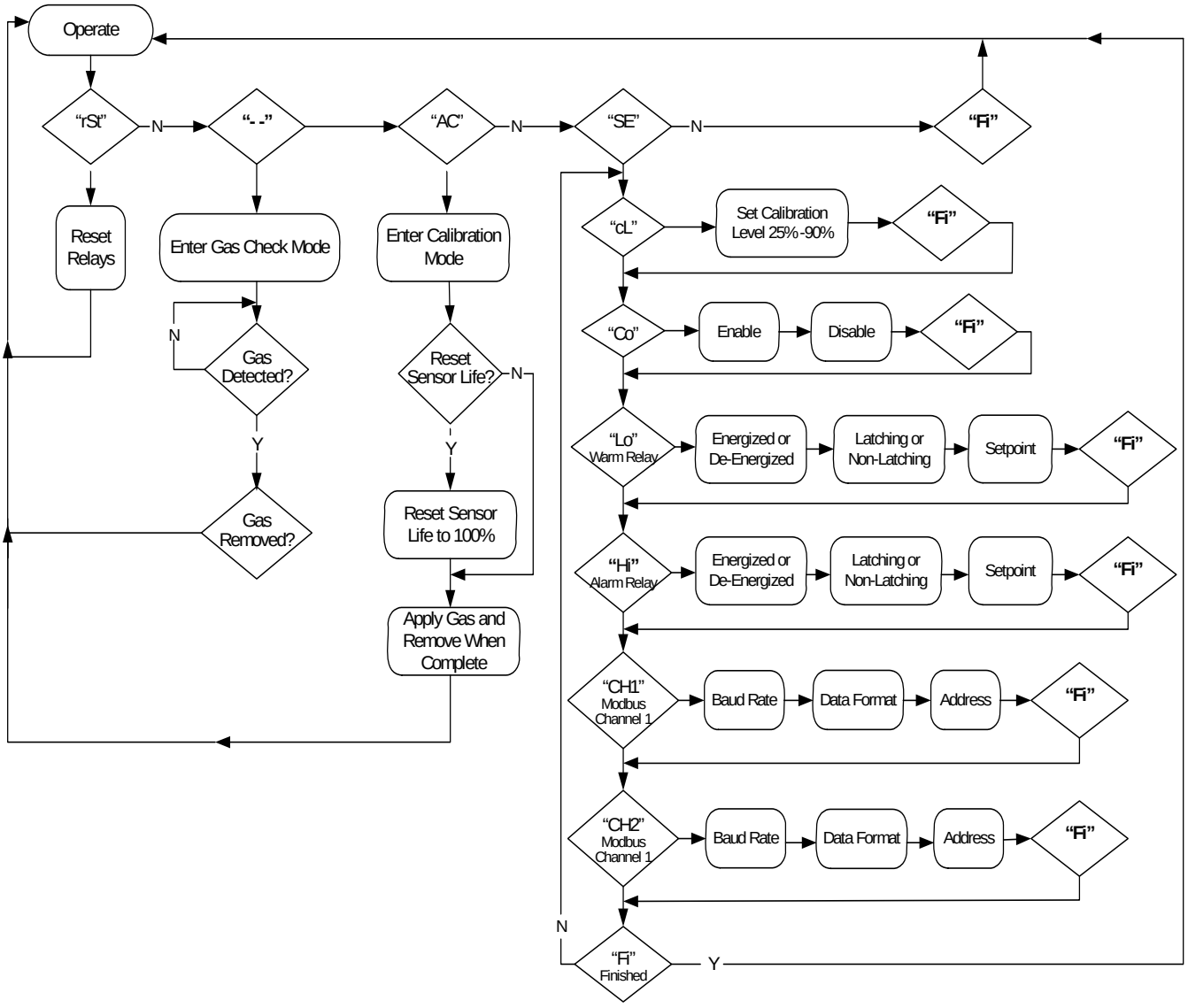


Figure 11: User Menu Structure

NOTE: "Co" represents Calibration Output. When "Co" is enabled and calibration is successful, the analog output goes from 1.5 mA to 3.2 mA for 5 seconds, settling at the desired value of 4mA.

4.4.2 Calibration Level

To adjust the calibration level of the Model S4000C, apply the magnet to the GM Logo on the cover of the unit, until "**SE**" is displayed, then remove the magnet. This puts the unit into Setup Mode. After a few seconds "**cL**" will be displayed. Apply and remove the magnet to adjust the calibration level. The current calibration level will be displayed. To change the calibration level, apply and remove the magnet repeatedly, until the desired level is displayed. Holding the

magnet in place will cause the display to advance rapidly after a few seconds. Once the desired value is displayed, wait 3 seconds and "**Fi**" will be displayed. Apply and remove the magnet to return to the next level of the Setup menu. When "**Fi**" is displayed again, apply and remove the magnet to return to normal operation. **The default calibration level is 50% LEL**.

4.4.3 Warning Relay Settings

To adjust the Warning Relay Settings of the Model S4000C, apply the magnet to the GM Logo on the cover of the unit until "**SE**" is displayed, then remove the magnet. This puts the unit into Setup Mode. After a few seconds "**Lo**" will be displayed. Apply and remove the magnet to change the Warning or "Low" alarm settings.

First, the Energized/De-Energized state of the relay is shown by either "**En**" or "**dE**" being displayed, respectively. Apply and remove the magnet until the desired state is displayed.

After a few seconds, the Latching/Non-Latching state of the relay is shown by either "**La**" or "**nL**". Apply and remove the magnet, until the desired state is displayed.

After a few seconds, the current Warning relay set point is displayed. Apply and remove the magnet, until the desired set point is displayed. Once the desired set point value is displayed, wait 3 seconds and "**Fi**" will be displayed. Apply and remove the magnet to return to the next level of the Setup menu. When "**Fi**" is displayed again, apply and remove the magnet, to return to normal operation.

The default Warning relay settings are: non-latching, de-energized, 30% LEL set point.

NOTE: The Warn relay set point cannot be set higher than the Alarm Relay set point, or higher than 60% LEL.

4.4.4 Alarm Relay Settings

To adjust the Alarm Relay Settings of the Model S4000C, apply the magnet to the GM Logo on the cover of the unit until "**SE**" is displayed, then remove the magnet. This puts the unit into Setup Mode. After a few seconds "**Hi**" will be displayed. Apply and remove the magnet to change the Alarm or "High" alarm settings.

First, the Energized/De-Energized state of the relay is shown by either "**En**" or "**dE**" being displayed respectively. Apply and remove the magnet, until the desired state is displayed.

After a few seconds, the Latching/Non-Latching state of the relay is shown by either "**La**" or "**nL**". Apply and remove the magnet, until the desired state is displayed.

After a few seconds, the current Alarm relay set point is displayed. Apply and remove the magnet until the desired set point is displayed. Once the desired set point value is shown, wait 3 seconds and "**Fi**" will be displayed. Apply and remove the magnet to return to the next level of the Setup menu. When "**Fi**" is displayed again, apply and remove the magnet to return to normal operation.

The default Alarm relay settings are: latching, de-energized, 60% LEL set point.

NOTE: The Alarm relay set point cannot be set lower than the Warning Relay set point, or higher than 60% LEL.

4.4.5 MODBUS Channel 1 Settings

To change the MODBUS Channel 1 settings of the Model S4000C, apply the magnet to the GM Logo on the cover of the unit until "**SE**" is displayed, then remove the magnet. This puts the unit into Setup Mode. After a few seconds "**CH1**" will be displayed. Apply and remove the magnet to change the MODBUS Channel 1 settings.

First, the current Baud Rate MODBUS Channel 1 is displayed. If another baud rate is to be selected, apply and remove the magnet until the desired baud rate is displayed. The choices are: 19.2k baud "**19.2**", 9600 baud "**96**", 4800 baud "**48**", or 2400 baud "**24**".

After a few seconds, the current Data Format for MODBUS Channel 1 is displayed. If another data format is to be selected, apply and remove the magnet until the desired data format is displayed. The choices are: 8-N-1 "**8n1**", 8-N-2 "**8n2**", 8-E-1 "**8E1**", or 8-O-1 "**8O1**".

After a few seconds, the current address for MODBUS Channel 1 is displayed. Apply and remove the magnet until the desired address is displayed. Once the desired address is displayed, wait 3 seconds and "**Fi**" will be displayed. Apply and remove the magnet to return to the next level of the Setup menu. When "**Fi**" is displayed again, apply and remove the magnet to return to normal operation.

Default settings for Channel 1 are: address 1, 19.2k baud, 8-N-1.

NOTE: The address can be adjusted from 1 - 247. Channel 1 and Channel 2 addresses may be the same.

4.4.6 MODBUS Channel 2 Settings

To change the MODBUS Channel 2 Settings of the Model S4000C, apply the magnet to the GM Logo on the cover of the unit until "**SE**" is displayed, then remove the magnet. This puts the unit into Setup Mode. After a few seconds "**CH2**" will be displayed. Apply and remove the magnet to change the MODBUS Channel 2 settings.

First, the current Baud Rate MODBUS Channel 2 is displayed. If another baud rate is to be selected, apply and remove the magnet until the desired baud rate is displayed. The choices are: 19.2 kbaud "**19.2**", 9600 baud "**96**", 4800 baud "**48**", or 2400 baud "**24**".

After a few seconds, the current Data Format for MODBUS Channel 2 is displayed. If another data format is to be selected, apply and remove the magnet until the desired data format is displayed. The choices are: 8-N-1 "**8n1**", 8-N-2 "**8n2**", 8-E-1 "**8E1**", or 8-O-1 "**8O1**".

After a few seconds, the current address for MODBUS Channel 2 is displayed. Apply and remove the magnet until the desired address is displayed. Once the desired address is displayed, wait 3 seconds and "**Fi**" will be displayed. Apply and remove the magnet to return to the next level of the Setup menu. When "**Fi**" is displayed again, apply and remove the magnet to return to normal operation.

Default settings for Channel 2 are: address 2, 19.2 kbaud, 8-N-1.

NOTE: The address can be adjusted from 1 - 247. Channel 1 and Channel 2 addresses may be the same.

4.5 Gas Check Mode

The sensor response can be checked without activating external alarms by placing the Model S4000C in Gas Check Mode. In this Mode, the alarm relays are inhibited and the analog output is fixed at 1.5mA.

4.5.1 Procedure for Checking the Calibration

Place the magnet over the GM Logo on the cover of the Model S4000C. Remove the magnet when a flashing pair of bars, "**- -**" (Figure 12), appears on the display (about ten seconds). Apply the test gas to the sensor; the value of the gas concentration will be indicated by the flashing display, and should stabilize in one to two minutes.

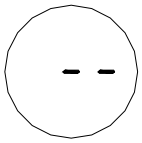


Figure 12: Calibration Check

When the reading has stabilized and the test is complete, remove the gas and the unit will return to normal operation when the concentration drops below 5% full-scale.

If, after the reading has stabilized, the sensor is to be calibrated, simply apply the magnet to the GM Logo on the housing cover, and the unit will enter Calibration Mode.

Gas Check Mode can be aborted if gas has not been applied to the sensor. Simply reapply the magnet to the GM Logo on the cover and the unit will return to normal operation.

NOTE: The test gas concentration must be at least 10% full-scale before the unit will complete the gas check sequence. If the Model S4000C is placed in the Gas Check Mode and no gas is applied for six minutes, the unit will revert to a Fault condition. Re-applying the magnet over the GM Logo will return the unit to normal operation.

4.6 Calibration

General Monitors recommends that the Model S4000C Intelligent Sensor be calibrated one hour after start-up, and that the calibration be checked at least every ninety (90) days to ensure system integrity. Frequent calibration checks ensure the integrity of the life protecting equipment.

The above statement is not intended to discourage the customer from checking calibration more frequently. Frequent calibration checks are recommended for environments that have problems, such as mud collecting on the sensor head, sensors accidentally being painted over, etc.

General Monitors recommends that a calibration schedule be established and followed. A logbook should also be kept, showing calibration dates and dates of sensor replacement.

4.6.1 Calibration Procedure

If it is suspected that gases are present, it will be necessary to purge the sensor environment with Zero Air. If Zero Air is not available, cover the sensor for about thirty seconds before applying the calibration gas. Zero Air is air that is hydrocarbon free.

Entering Calibration Mode automatically disables the alarm circuits by sending a 1.5mA output signal and disabling the Warn and Alarm relays, if present. This will also prevent activation of the remote relay contacts when using a General Monitors Readout/Relay Display Module with the Model S4000C.

To enter Calibration Mode, place the magnet over the GM Logo on the cover of the unit (Figure 4) and hold it there until "**AC**" (Figure 13) appears on the display (about ten seconds). The display will flash the remaining sensor life (Section 4.6.4) for about ten seconds, while the unit acquires the zero reading. Ensure that the sensor is seeing clean air during this time.

Figure 13: Automatic Calibration Mode

Apply the calibration gas concentration to the sensor (usually 50% LEL of the desired gas). The display will change from "**AC**" (Automatic Calibration) to "**CP**" (Calibration in Progress), indicating that the sensor is responding to the calibration gas (Figure 14).

Figure 14: Calibration In Progress Mode

After one or two minutes, the display will change from "**CP**" to "**CC**" (Figure 15), indicating that the calibration is complete.

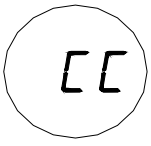


Figure 15: Calibration Complete Mode

Remove the gas and wait for the unit to return to normal operation. The display will indicate a few percent full-scale and then drop to "**0**".

The unit is now calibrated and the new ZERO and SPAN values have been stored in the non-volatile memory (EEPROM).

4.6.2 Aborting Calibration

If calibration is to be aborted, and gas has not been applied, wait ninety seconds and reapply the magnet. The unit will return to normal operation with the previous calibration values unchanged.

NOTE: Once gas has been applied, it is not possible to abort a calibration.

If the Model S4000C is placed in the Calibration Mode and no gas is applied for six minutes, the unit will revert to a Fault condition. Re-applying the magnet over the GM Logo will return the unit to operational mode with the previous calibration values unchanged.

4.6.3 Adjustable Calibration Level

The Model S4000C provides the user with the ability to adjust the calibration level from 25% LEL to 90% LEL. The default value from the factory is 50% LEL. This allows the user to utilize gas already available at their installation, that is not 50% LEL of the gas being detected, or to perform cross-calibration to a similar gas. Adjusting the Calibration Level is performed in Setup Mode.

NOTE: %LEL to %Volume Fraction is converted by using 325 Guide to Fire Hazard properties of Flammable Liquids, Gases, and Volatile Solids. For example, 100% LEL CH4 is shown in NFPA to be 5% Volume, Calibration is at 50% LEL or 2.5% Volume.

WARNING: General Monitors recommends calibrating the Model S4000C with 50% LEL of the gas being detected. This provides the most accurate calibration, since the Model S4000C is optimized for this concentration. The accuracy of the calibration may be reduced by using a different calibration level, and this inaccuracy will increase as the calibration level varies from 50% LEL.

4.6.4 Remaining Sensor Life

The Model S4000C Intelligent Sensor provides an estimate of remaining sensor life, in percent remaining, to provide the user with an early warning of the need for sensor replacement. The remaining sensor life is updated each time the unit is calibrated. The current remaining sensor life estimate is displayed during the zeroing portion of a calibration sequence. It can also be read via the MODBUS interface (Section 8.8.17).

NOTE: The remaining sensor life provides an estimate of the amount of life remaining for the sensor. Many factors including, environmental conditions, poisons, etc can affect this estimate. It should be used only as an estimate for preventive maintenance and logistic purposes.

4.6.5 Initializing the Remaining Sensor Life

The remaining sensor life estimate must be initialized each time a new Hydrocarbon Sensor is installed. The initialization should be done during the first calibration of a newly installed sensor. After the sensor has been on power for a minimum of one hour, enter calibration mode as

described in Section 4.6.1. While the display is flashing the remaining sensor life estimate during zeroing, apply the magnet to the GM Logo on the cover. The flashing number will change to "**100**", indicating the sensor has 100% of remaining sensor life. Complete the calibration per Section 4.6.1.

4.7 Calibration Equipment

4.7.1 Portable Purge Calibrator

The portable purge calibrator is a compact, accurate and safe system containing a non-explosive gas concentration. The lecture bottle is filled with a standard 50% LEL mixture of gas/air. Using a known gas/air mixture reduces the likelihood of error in field calibration. The hose and cup adapter included, allow for quick calibrations and gas checks.

Pre-mixed calibration gases at approximately 50% LEL are available, in lecture bottles, at 1200 psi, 8.3 MPa maximum pressure.

Hydrogen H_2

Methane CH_4

Propane C_3H_8

Please specify the gas upon ordering. Spare bottles containing these gases may be ordered. Methane and Hydrogen lecture bottles may be returned to General Monitors for refilling.

5.0 Maintenance

5.1 General Maintenance

WARNING: Disconnect or inhibit external devices such as Trip Amplifiers, PLC's, or DCS systems before performing any maintenance.

European Union (EU) Approved Applications: The following grease compound is recommended for use: PBC Polybutylcuprysil, (or equivalent), which has BASEEFA Health & Safety Executive component approval No. 1051U for use as a jointing compound on flameproof electrical enclosures. This is available from General Monitors.

The neoprene rubber gasket, if it is found dry should also be lubricated with Type P80 lubricant, available from General Monitors (P/N 610-010).

5.2 Storage

The Model S4000C Combustible Gas Detector should be stored in a clean, dry area, and within the temperature and humidity ranges quoted in the Appendix under Environmental Specifications.

Insert red dust caps into any vacant cable entry holes.

6.0 Troubleshooting

CAUTION: Component level repair must be undertaken either by General Monitors' personnel, or by competent authorized service engineers. SMT PCB repair shall only be performed at a General Monitors facility. Failure to comply with this requirement will invalidate the warranty.

Be sure to inhibit or disconnect external alarm wiring before making any check, which might send the unit into alarm, if an alarm condition will cause a problem.

6.1 Fault Codes & Their Remedies

The Model S4000C has self-diagnostics incorporated into the microprocessor's program. If a Fault is detected, the output signal will drop to 0mA, the Fault relay will de-energize and a Fault code will be displayed. The output signal will inform a remote display module that the Model S4000C is in the Fault Mode. The display will indicate a Fault code that can be viewed at the sensor site.

There are nine Fault conditions that are monitored by the microprocessor, as follows:

6.1.1 F2 Failed to Complete Calibration

This Fault will occur if the unit is placed in the calibration mode and no gas has been applied within six minutes, or if gas has been left on for more than six minutes.

ACTION – Remove gas, if present. Apply the magnet to the GM Logo on the cover to clear the fault. Attempt to calibrate.

6.1.2 F3 EEPROM Checksum Error

This fault indicates that the contents of the Model S4000C's program memory have changed. This usually occurs, when powering the unit up after a lightning strike or large voltage transient on the power or signal lines to the unit.

ACTION - The unit must be returned to the factory or authorized service center for repair.

6.1.3 F4 Sensor Error

This fault indicates that either one of the remote sensor leads is open or shorted, or that the sensor has drifted greater than –10%.

ACTION - Check the integrity of all sensor connections, and ensure that the cable from the Model S4000C to the remote sensor is not damaged. If all sensor leads are connected properly, attempt to re-calibrate the unit. If calibration fails, replace the sensor and re-calibrate.

6.1.4 F5 Unused

6.1.5 F6 Low Supply Voltage

This fault occurs if the supply voltage at the S4000C drops below +18.5VDC.

ACTION - Ensure that the supply voltage is at least +20VDC at the Model S4000C.

NOTE: With long supply leads, a considerable voltage drop may occur, due to the electrical resistance of the leads. The maximum cable resistance, which the Model S4000C can tolerate, is dependent on the supply voltage: a maximum of 20 ohms per conductor (40 ohms loop), at +24VDC minimum, or a maximum of 10 ohms per conductor (20 ohms loop), at +20VDC minimum.

6.1.6 F7 EEPROM Verification Failure

This fault occurs when an attempt to verify the setup/calibration parameters just written to the EEPROM memory fails.

ACTION - The unit must be returned to the factory or authorized service center for repair.

6.1.7 F8 Failure to Complete Setup

This fault occurs if the unit is left in setup mode for more than 6 minutes.

ACTION - Exit setup mode. Enter setup mode again if it is necessary to change any user selectable options.

6.1.8 F9 Gas Check Period Exceeded

If the Model S4000C is left in the gas check mode for more than six minutes without a Test Gas being applied or if test gas is left on the gas check mode for more than 6 minutes, this fault will occur.

ACTION - Place the magnet over the GM Logo on the cover to return the unit to normal operation.

NOTE: Anytime a sensor is replaced, the unit should be disconnected from all alarms, as the unit may go upscale upon power-up.

6.1.9 F10 Switch Error

This fault occurs if the remote reset, remote calibrate, or the magnetic switch are closed for more than two minutes.

ACTION – Check the wiring on the remote reset and remote calibrate switches. Once the short circuit is cleared, the unit will return to normal operation. If the magnetic switch is shorted, the unit must be returned to the factory or authorized service center for service.

7.0 Customer Support

7.1 General Monitors' Offices

Area	Phone/Fax/Email
UNITED STATES	
	Toll Free: +1-800-446-4872
Corporate Office:	Phone: +1-949-581-4464
26776 Simpatica Circle	Fax: +1-949-581-1151
Lake Forest, CA 92630	Email: info@generalmonitors.com
9776 Whithorn Drive	Phone: +1-281-855-6000
Houston, TX 77095	Fax: +1-281-855-3290
	Email: gmhou@generalmonitors.com
UNITED KINGDOM	
Heather Close	Phone: +44-1625-619-583
Lyme Green Business Park	Fax: +44-1625-619-098
Macclesfield, Cheshire,	Email: info@generalmonitors.co.uk
United Kingdom, SK11 0LR	
IRELAND	
Ballybrit Business Park	Phone: +353-91-751175
Galway, Republic of Ireland	Fax: +353-91-751317
	Email: info@gmil.ie
SINGAPORE	
No. 2 Kallang Pudding Rd.	Phone: +65-6-748-3488
#09-16 Mactech Building	Fax: +65-6-748-1911
Singapore 349307	Email: genmon@gmpacifica.com.sg
MIDDLE EAST	
LOB12, #G20	Phone: +971-4-8815751
P.O. Box 61209	Fax: +971-4-8817927
Jebel Ali, Dubai	Email: gmme@emirates.net.ae
United Arab Emirates	

Table 8: GM Locations

8.0 MODBUS Interface

8.1 Baud Rate

The Baud Rate is selectable via the MODBUS Communications Interface. The selectable baud rates are 19200, 9600, 4800, or 2400 bits per second.

8.2 Data Format

The Data Format is selectable via the MODBUS Communications Interface. The selectable data formats are as follows:

Data Bits	Parity	Stop Bit	Format
8	None	1	8-N-1
8	Even	1	8-E-1
8	Odd	1	8-O-1
8	None	2	8-N-2

Table 9: Data Format

8.3 MODBUS Read Status Protocol (Query/Response)

8.3.1 MODBUS Read Query Message

Byte	MODBUS	Range	Referenced to S4000C
1st	Slave Address	1-247* (Decimal)	S4000C ID (Address)
2nd	Function Code	03	Read Holding Registers
3rd	Starting Address Hi**	00	Not Used by S4000C
4th	Starting Address Lo**	00-FF (Hex)	S4000C Commands
5th	No. of Registers Hi	00	Not Used by S4000C
6th	No. of Registers Lo	01	No. of 16 Bit Registers
7th	CRC Lo	00-FF (Hex)	CRC Lo Byte
8th	CRC Hi	00-FF (Hex)	CRC Hi Byte

***NOTE:** Address 0 is reserved for broadcast mode and will not be supported at this time.

****NOTE:** Start Address can be a maximum of 9999 Address Locations (0000-270E).

8.3.2 MODBUS Read Response Message

Byte	MODBUS	Range	Referenced to S4000C
1st	Slave Address	1-247* (Decimal)	S4000C ID (Address)
2nd	Function Code	03	Read Holding Registers
3rd	Byte Count	02	No. of Data Bytes
4th	Data Hi	00-FF (Hex)	S4000C Hi Byte Status Data
5th	Data Lo	00-FF (Hex)	S4000C Lo Byte Status Data
6th	CRC Lo	00-FF (Hex)	CRC Lo Byte
7th	CRC Hi	00-FF (Hex)	CRC Hi Byte

8.4 MODBUS Write Command Protocol (Query/Response)

8.4.1 MODBUS Write Query Message

Byte	MODBUS	Range	Referenced to S4000C
1st	Slave Address	1-247* (Decimal)	S4000C ID (Address)
2nd	Function Code	06	Preset Single Register
3rd	Register Address Hi	00	Not Used by S4000C
4th	Register Address Lo	00-FF (Hex)	S4000C Commands
5th	Preset Data Hi	00-FF (Hex)	S4000C Hi Byte Command Data
6th	Preset Data Lo	00-FF (Hex)	S4000C Lo Byte Command Data
7th	CRC Lo	00-FF (Hex)	CRC Lo Byte
8th	CRC Hi	00-FF (Hex)	CRC Hi Byte

***NOTE:** Address 0 is reserved for broadcast mode and will not be supported at this time.

****NOTE:** Start Address can be a maximum of 9999 Address Locations (0000-270E)

8.4.2 MODBUS Write Response Message

Byte	MODBUS	Range	Referenced to S4000C
1st	Slave Address	1-247* (Decimal)	S4000C ID (Address)
2nd	Function Code	06	Preset Single Register
3rd	Register Address Hi	00	Not Used by S4000C
4th	Register Address Lo	00-FF (Hex)	S4000C Commands
5th	Preset Data Hi	00-FF (Hex)	S4000C Hi Byte Command Data
6th	Preset Data Lo	00-FF (Hex)	S4000C Lo Byte Command Data
7th	CRC Lo	00-FF (Hex	CRC Lo Byte
8th	CRC Hi	00-FF (Hex)	CRC Hi Byte

8.5 Function Codes Supported

Function Code 03 (Read Holding Registers) will be used to read status from the slave unit.

Function Code 06 (Preset Single Register) will be used to write a command to the slave unit.

8.6 Exception Responses and Exception Codes

8.6.1 Exception Response

In a normal communications query and response, the master device sends a query to the S4000C and the S4000C receives the query without a communications error and handles the query normally within the master device's allowable timeout. The S4000C then returns a normal response to the master. An abnormal communications query produces one of four possible events:

1. If the S4000C does not receive the query due to a communications error, then no response is returned from the S4000C and the master device will eventually process a timeout condition for the query.

2. If the S4000C receives the query, but detects a communication error (CRC, etc.), then no response is returned from the S4000C and the master device will eventually process a timeout condition for the query.

3. If the S4000C receives the query without a communications error, but cannot process the response to the master within the master's timeout setting, then no response is returned from the S4000C. The master device will eventually process a timeout condition for the query. **In order to prevent this condition from occurring, the maximum response time for the S4000C is 200 milliseconds. Therefore the master's timeout setting should be set to 200 milliseconds or greater.**

4. If the S4000C receives the query without a communications error, but cannot process it due to reading or writing to a non-existent S4000C command register, then the S4000C will return an exception response message informing the master of the error.

Byte	MODBUS	Range	Referenced to S4000C
1st	Slave Address	1-247* (Decimal)	S4000C ID (Address)
2nd	Function Code	83 or 86 (Hex)	MSB is set with Function Code
3rd	Exception Code	01 - 06 (Hex)	Appropriate Exception Code (See Below)
4th	CRC Lo	00-FF (Hex)	CRC Lo Byte
5th	CRC Hi	00-FF (Hex)	CRC Hi Byte

The exception response message (ref. No. 4 above) has two fields that differentiate it from a normal response:

8.6.2 Exception Code

Exception Code Field: In a normal response, the S4000C returns data and status in the data field, which was requested in the query from the master. In an exception response, the S4000C returns an exception code in the data field, which describes the S4000C condition that caused the exception. Below is a list of exception codes that are supported by the S4000C:

Code	Name	Description
01	Illegal Function	The function code received in the query is not an allowable action for the S4000C.
02	Illegal Data Address	The data address received in the query is not an allowable address for the S4000C.
03	Illegal Data Value	A value contained in the query data field is not an allowable value for the S4000C.
04	Slave Device Failure	An unrecoverable error occurred while the S4000C was attempting to perform the requested action.
05	Acknowledge	The S4000C has accepted the request and is processing it, but a long duration of time will be required to do so. This response is returned to prevent a timeout error from occurring in the master.
06	Device Busy	The S4000C is engaged in processing a long-duration program command. The master should retransmit the message later when the slave is free.

Table 10: Exception Codes

8.7 S4000C Command Register Locations

Parameter	Function	Type	Scale	Access	Register Address	Master I/O Address
Analog	0-20mA Current Output	Value	16-Bit	R	0000	40001
Mode	Indicates and Controls Mode	Bit		R/W	0001	40002
Status/Error	Indicates Errors	Bit		R	0002	40003
Not Used	N/A					40004
Unit Type	Identifies the S4000C in Decimal	Value	16-Bit	R	0004	40005
Software Rev	Indicates the Software Revision	ASCII	2-Char	R	0005	40006
Status Block	Returns Analog, Mode, Status, Error, and Sensor Life	Multi	6-bytes	R	0006	40007
Not Used	N/A					40008-40013
Alarm Settings	Read or change settings for the high alarm	Bit	(0-15)	R/W	000D	40014
Warn Settings	Read or change settings for the low alarm	Bit	(0-15)	R/W	000E	40015
Com1 Addr	Read or change settings for the Com1 Address	Value	8-Bit	R/W	000F	40016
Com1 Baud	Read or change settings for the Com1 Baud Rate	Bit	(0-7)	R/W	0010	40017
Com1 Data Format	Read or change settings for the Com1 Data Format	Bit	(0-7)	R/W	0011	40018
Com2 Addr	Read or change settings for the Com2 Address	Value	8-Bit	R/W	0012	40019
Com2 Baud	Read or change settings for the Com2 Baud Rate	Bit	(0-7)	R/W	0013	40020
Com2 Data Format	Read or change settings for the Com2 Data Format	Bit	(0-7)	R/W	0014	40021
Cal Level	Read or change settings for the calibration level	Value	8-Bit	R/W	0015	40022
Reset Alarms	Reset any latched alarms	Bit	(0)	W	0016	40023
Sensor Life	Read the Remaining Sensor Life	Bit	(0)	R	0017	40024
HazardWatch (Co)	Indicate Calibration Success	Value	8-bit	R/W	0019	40026
Not Used	N/A					40025, 40027-40032
Total Receive Errors	Total # of Receive Errors	Value	8-Bit	R	0020	40033
Bus Activity Rate %	Bus Activity Rate in % of This Addressed Node vs. Other Addressed Nodes	Decimal		R	0021	40034
Function Code Errors	Total # of Function Code Errors	Value	8-Bit	R	0022	40035
Starting Addr Errors	Total # of Starting Address Errors	Value	8-Bit	R	0023	40036
No of Register Errors	Total # of Register Errors	Value	8-Bit	R	0024	40037

Table 11: Command Register Locations

Parameter	Function	Type	Scale	Access	Register Address	Master I/O Address
RXD CRC Hi Errors	Total # of RXD CRC Hi Errors	Value	8-Bit	R	0025	40038
RXD CRC Low Errors	Total # of RXD CRC Low Errors	Value	8-Bit	R	0026	40039
Not Used	N/A				0027 – 002C	40040 - 40045
Clear Comm Errors	Clear All Comm Errors	Bit	(0)	W	002D	40046

Table 12: Command Register Locations Cont.

8.8 S4000C Command Register Details

8.8.1 Analog

A read returns a value, which is proportional to the 0-20mA output current. The current is based on a 16-bit value. The scaling is 0 - 65535 decimal which corresponds to 0 - 21.7mA.

8.8.2 Mode

A read returns the present mode of the S4000C. A write command changes the mode to the requested mode.

Exception: Returns an Exception Code 01 (illegal function) if an illegal write is requested.

A calibrate command returns an Exception Code 01 (Acknowledge 05). The operation will take a long time to complete.

Function	Bit Position	Access
Calibration Complete	7 MSB	Read
Spanning	6	Read
Zero Complete, Waiting for Gas	5	Read
Zeroing	4	Read
Calibration Mode	3	Read/Write
Calibration Check Mode	2	Read/Write
Run Mode	1	Read
Startup Mode	0 LSB	Read

8.8.3 Status/Error

A read returns the Alarm state and Errors that are occurring at the present time, which are indicated, by bit position.

Function	Bit Position	Access
Alarm	15 MSB	Read
Warn	14	Read
Fault	13	Read

Not Used	12	Read
Not Used	11	Read
Not Used	10	Read
Not Used	9	Read
Switch Error	8	Read
Setup Error	7	Read
Calibration Check Timeout	6	Read
EEPROM Error	5	Read
EPROM Error	4	Read
Sensor Error	3	Read
Fail to Calibrate	2	Read
Low Supply Voltage	1	Read

8.8.4 Unit Type

A read returns the Decimal Value 4000. This identifies the S4000C.

A read returns the Decimal Value 4001. This identifies the S4000T.

8.8.5 Software Revision

A read returns the software revision of the S4000C in 2 ASCII characters.

8.8.6 Status Block

A read returns a 6-byte message containing the analog (2 bytes), Mode (1 byte), Status/Error (2 bytes), and Sensor Life (1 byte) in that order. For the format of each byte, refer to the appropriate individual commands.

8.8.7 Alarm Settings

A read returns the present Alarm settings of the S4000C. A write command changes the settings to the requested values. The set points are programmable in 5% FS steps.

NOTE: The maximum alarm setting for the S4000C is 60%.

A 1 in the 9th bit position means the output is latching, a 0 means it is Non-Latching. A 1 in the 8th bit position means the output is normally energized a 0 means it is normally De-Energized. The Alarm set point cannot be set below the Warn set point.

Factory default is 60%FS, latching, de-energized.

Exception: Returns an Exception Code 01 (Illegal Function) if an illegal write is requested.

Byte	Function	Bit Position	Access
High	Not Used	15 MSB	Read
	Not Used	14	Read
	Not Used	13	Read
	Not Used	12	Read
	Not Used	11	Read
	Not Used	10	Read
	Latching/Non-Latching	9	R/W
	Energized/De-Energized	8	R/W
Low	Set point	(7-0)	R/W

8.8.8 Warn Settings

A read returns the present Warn settings of the S4000C. A write command changes the settings to the requested values. The set points are programmable in 5% FS steps.

NOTE: The maximum warn setting for the S4000C is 60%.

A 1 in the 9th bit position means the output is latching, a 0 means it is Non-Latching. A 1 in the 8th bit position means the output is normally energized, a 0 means it is normally De-Energized. The Warn set point cannot be set above the Alarm set point.

Factory default is 30% FS, non-latching, de-energized.

Exception: Returns an Exception Code 01 (Illegal Function) if an illegal write is requested.

Byte	Function	Bit Position	Access
High	Not Used	15 MSB	Read
	Not Used	14	Read
	Not Used	13	Read
	Not Used	12	Read
	Not Used	11	Read
	Not Used	10	Read
	Latching/Non-Latching	9	R/W
	Energized/De-Energized	8	R/W
Low	Set point	(7-0)	R/W

8.8.9 Com1 Address

A read command returns the current address for Com1. A write command changes the address to the requested value. Valid addresses are 1-247 decimal. **Factory default is 1.**

Exception: If the address is not in range, an illegal data value (03) is returned.

8.8.10 Com1 Baud Rate

A read command returns the current baud rate for Com1. A write command changes the baud rate to the requested values. Valid settings are shown in the table below. **Factory default is 19,200.**

Baud Rate	Value	Access
2400	24	Read/Write
4800	48	Read/Write
9600	96	Read/Write
19,200	192	Read/Write

Table 13: Com1 Baud Rate

Exception: If the baud rate is not in range, an illegal data value (03) is returned.

8.8.11 Com1 Data Format

A read command returns the current data format for Com1. A write command changes the data format to the requested values. Valid settings are shown in the table below. **Default format is 8-N-1.**

Data	Parity	Stop	Format	Data(Bits 9-8)	Access
8	None	1	8-N-1	0	Read/Write
8	Even	1	8-E-1	1	Read/Write
8	Odd	1	8-O-1	2	Read/Write
8	None	2	8-N-2	3	Read/Write

Table 14: Com1 Data Format

Exception: If the data format is not in range, an illegal data value (03) is returned.

8.8.12 Com2 Address

A read command returns the current address for Com2. A write command changes the address to the requested values. Valid addresses are 1-247 decimal. **Factory default is 2.**

Exception: If the address is not in range, an illegal data value (03) is returned.

8.8.13 Com2 Baud Rate

A read command returns the current baud rate for Com2. A write command changes the baud rate to the requested values. Valid settings are shown in the table below. **Factory default is 19,200.**

Baud Rate	Value	Access
2400	24	Read/Write
4800	48	Read/Write
9600	96	Read/Write
19,200	192	Read/Write

Table 15: Com2 Baud Rate

Exception: If the baud rate is not in range, an illegal data value (03) is returned.

8.8.14 Com2 Data Format

A read command returns the current data format for Com2. A write command changes the data format to the requested values. Valid settings are shown in the table below. **Factory default is 8-N-1.**

Data	Parity	Stop	Format	Data(Bits 9-8)	Access
8	None	1	8-N-1	0	Read/Write
8	Even	1	8-E-1	1	Read/Write
8	Odd	1	8-O-1	2	Read/Write
8	None	2	8-N-2	3	Read/Write

Table 16: Com2 Data Format

Exception: If the data format is not in range, an illegal data value (03) is returned.

8.8.15 Cal Level

A read returns the current settings for the Calibration Level. A write changes the Calibration Level that will be used during the next and subsequent calibrations. Valid levels are 25 to 90.

8.8.16 Reset Alarms

A write to this register with a data value of 1 will reset any latched alarms provided the current gas level is below the alarm set point.

On the S4000C it will also reset the latching over-range function provided the gas level is below 100% LEL.

8.8.17 Sensor Life

A read returns the current estimate of remaining sensor life in percentage.

8.8.18 HazardWatch (Co – Calibration Output)

A read to this register will return the status of the HazardWatch Option.

0x01 enables this option, 0x00 disables this option, similar to the write.

NOTE: Only Com1 can support read/write to this register.

8.8.19 Total Receive Errors

A read indicates the total MODBUS Comm Receive Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again. The total errors are an accumulation of the individual communication errors listed below.

8.8.20 Bus Activity Rate %

A read indicates the Bus Activity Rate in percent of this Slave's addressed node versus other addressed nodes. Range of this value is in hex (0-64), which translates to decimal (0-100%).

8.8.21 Function Code Errors

A read indicates the number of Function Code Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

8.8.22 Starting Address Errors

The counter is incremented for each address that does not equal the device address.

A read indicates the number of Starting Address Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

8.8.23 Number of Register Errors

A read indicates the Number of Register Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

8.8.24 RXD CRC Hi Errors

A read indicates the number of RXD CRC Hi Byte Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

8.8.25 RXD CRC Low Errors

A read indicates the number of RXD CRC Low Byte Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

8.8.26 Clear Comm Errors

A Read or Write resets all the MODBUS Comm Error counters to zero.

9.0 Appendix

9.1 Warranty

General Monitors warrants the Model S4000C to be free from defects in workmanship or material under normal use and service within two years from the date of shipment.

General Monitors will repair or replace without charge any such equipment found to be defective during the warranty period. Full determination of the nature of, and responsibility for, defective or damaged equipment will be made by General Monitors' personnel.

Defective or damaged equipment must be shipped to the General Monitors' plant, or representative from which the original shipment was made. In all cases, this warranty is limited to the cost of the equipment supplied by General Monitors. The customer will assume all liability for the misuse of this equipment by its employees, or other personnel.

All warranties are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without General Monitors' approval or which have been subjected to neglect, accident, improper installation or application, or on which the original identification marks have been removed or altered.

Except for the express warranty stated above, General Monitors disclaims all warranties with regard to the products sold, including all implied warranties of merchantability and fitness, and the express warranties stated herein are in lieu of all obligations or liabilities on the part of General Monitors for damages including, but not limited to, consequential damages arising out of, or in connection with, the performance of the product.

9.2 Principle of Operation

Many gases and vapors are combustible. General Monitors uses a low temperature catalytic bead to detect the presence of combustible gases and vapors. The catalytic bead converts the combustible materials to heat. A change in heat is then converted to a change in resistance, which can be measured.

Taking a matched pair of catalytic beads and coating one so that it does not respond to the presence of combustible gases can compare the change in resistance between the two beads. The bead that is coated is called the reference bead and the other is called the active bead. Because the beads are a matched pair, they will respond equally to changes in ambient temperature, humidity, and pressure. This makes the sensor virtually immune to changing environmental conditions.

By connecting one end of each catalytic bead together, a series circuit is formed. This circuit is supplied with a constant current. The voltage drop across each of the beads will be identical in the absence of combustible gases. As combustible material is converted to heat, the resistance of the active bead increases, causing the voltage drop across each bead to be different. This difference is proportional to the amount of combustible gas that is present.

The voltage from the sensor is amplified and fed to an Analog to Digital (A/D) converter and then made available to the microprocessor. The baseline and the gain for the amplifier are set using digital potentiometers. They are adjusted by the microprocessor during calibration.

9.3 Specifications

9.3.1 System Specifications

Sensor Type:	Continuous diffusion, low temperature catalytic bead
Sensor Life:	3 to 5 years typical
Accuracy:	±3% LEL up to 50% LEL ±5% LEL ≥ 51% LEL
Zero Drift:	Less than 5% of full scale per year
Response Time:	T50<10 sec. T90<30 sec. with 100% LEL methane applied
Measuring Ranges:	0-100% LEL
Modes:	Calibration, gas check, setup
Electrical Classification:	CSA/FM: Class I, Division 1, Groups B, C, D and Class I, Zone 1, Ex d IIB+H_2, T6. ATEX: II 2 G EEx d IIB T5 (Tamb=-40°C to +70°C) EN 61779-1
Pressure Limits:	Up to 3 Atmospheres, sensor requires 15 minutes from start up to stablize
Warranty:	Two years

9.3.2 Mechanical Specifications

Length:	6.4 inches (161mm)
Height:	3.4 inches (86mm)
Width:	4.1 inches (104mm)
Weight:	5.5 lbs. (2.5 kg)
Mounting Holes:	5.0 inches (127mm) (center to center)

9.3.3 Electrical Specifications

Input Power:	24 VDC nominal, 20 to 36 VDC, 250mA max.
Power Consumption	Start-up 280mA, Normal Operation 160mA
Relay Ratings:	8A @ 250 VAC/8A @ 30 VDC resistive max.
(Optional)	(3x) SPDT - Warning, Alarm & Fault
Analog Signal:	0-20mA (650 ohms max. load) Malfunction 0mA Calibration 1.5mA Gas Check 1.5mA Setup mode 1.5mA Startup 4mA±0.2mA Zero reading 4mA±0.2mA 0-100% LEL 4-20mA Over-range 20-22mA
Status Indicators:	Three-digit digital display with gas concentration, Warn and Alarm LED's, calibration prompts, fault codes, and setup options
RS-485 Output:	Dual Redundant MODBUS RTU, suitable for linking
(Optional)	Up to 128 units or up to 247 units with repeaters
Baud Rate:	2400, 4800, 9600, or 19200 BPS
Faults Monitored:	Calibration error, open AO, sensor error, low DC supply, EEPROM, EPROM, setup error, gas check time exceeded, switch error
RFI/EMI Protection:	Complies with EN50081-2, EN50082-2

Cable Requirements:

3-wire shielded cable. Max. distance between S4000C and power source @ 24VDC nominal (20 ohm loop):

AWG	FEET	METERS
14	3430	1040
16	1900	580
18	1500	460
20	1000	300

Table 17: 24VDC Cable Lengths

Max. distance for analog output (650 ohms max):

AWG	FEET	METERS
14	9000	2740
16	5200	1585
18	3800	1160
20	2400	730

Table 18: Analog Output Cable Lengths

Max. Distance between the transmitter and sensor with one-way resistance of 20Ohms (40-Ohm loop):

AWG	FEET	METERS
14	7600	2320
16	4800	1460
18	3000	910
20	1900	580

Table 19: Sensor Cable Lengths

European Union (EU) Approved Applications: PSU noise and ripple voltage 1.0Vpp max. The customer supplied PSU must comply with **IEC** 61010-1, limiting current to 8A under Fault conditions, in order to comply with CE Marking requirements.

9.3.4 Environmental Specifications

Operating Temperature Range:

CSA/FM/ATEX:

Electronics	-40°F to 167°F (-40°C to +75°C)
Standard Sensor	-65°F to 200°F (-55°C to +93°C)
High Temp Sensor	-65°F to 400°F (-55°C to +200°C)
ATEX:	
Electronics (T5)	-40° F to 158° F (-40°C to +70°C)
Storage Temperature Range:	-58°F to 185°F (-50°C to +85°C)
Operating Humidity Range:	5% to 100% RH, non-condensing
Atmosphere:	Will not operate in <5% Oxygen Oxygen enriched reading may be slightly higher

9.4 Approvals

CSA, FM, ATEX approved.

Complies with ANSI/ISA-12.13.01-2000 performance requirements

9.5 Sensitivities to Other Gases

The S4000C responds to the following list of hydrocarbons up to C10

				Injection volumes		Cal Ratio	
Gases	**%LEL**	**M.W.**	**Density**	**50%lel/3L**	**50%lel/5L**	**Methane**	**Propane**
Acetylene	2.5	26.0	***	37.5 ml	62.5 ml	0.8	1.1
Ammonia	15.0	17.0	***	225.0 ml	375.0 ml	1.3	1.7
1,3- Butadiene	2.0	54.1	***	30.0 ml	50.0 ml	0.8	1.1
Butane	1.9	58.1	***	28.5 ml	47.5 ml	0.7	0.9
iso-Butane	1.8	58.1	***	27.0 ml	45.0 ml	0.6	0.8
1-Butene (Butylene)	1.6	56.1	***	24.0 ml	40.0 ml	0.7	0.9
cis-Butene-2	1.7	56.1	***	25.5 ml	42.5 ml	0.7	0.9
trans-Butene-2	1.8	56.1	***	27.0 ml	45.0 ml	0.7	0.9
iso-Butylene	1.8	56.1	***	27.0 ml	45.0 ml	0.7	0.9
Carbon Monoxide	12.5	28.0	***	187.5 ml	312.5 ml	0.9	1.2
Dimethylamine	2.8	45.1	***	42.0 ml	70.0 ml	0.6	0.8
Ethane	3.0	30.1	***	45.0 ml	75.0 ml	0.8	1.1
Ethylene Oxide	3.0	44.0	***	45.0 ml	75.0 ml	1.0	1.3
Ethylene (Ethene)	2.7	28.1	***	40.5 ml	67.5 ml	0.8	1.1
Hydrogen	4.0	2.0	***	60.0 ml	100.0 ml	0.8	1.1
Methane	5.0	16.0	***	75.0 ml	125.0 ml	1.0	1.3
Propane	2.1	44.1	***	31.5 ml	52.5 ml	0.8	1.0
Propylene (Propene)	2.0	42.1	***	30.0 ml	50.0 ml	0.8	1.0
Trimethylamine	2.0	59.1	***	30.0 ml	50.0 ml	0.6	0.8
Vinyl Chloride (Chloroethylene)	3.6	62.5	***	54.0 ml	90.0 ml	0.7	0.9
				Injection volumes		**Cal Ratio**	
Liquids	**%LEL**	**M.W.**	**Density**	**50%lel/3L**	**50%lel/5L**	**Methane**	**Propane**
Acetaldehyde	4.0	44.1	0.8	136 ul	228 ul	0.7	0.9
Acetic Acid	4.0	60.1	1.0	140 ul	234 ul	0.5	0.7
Acetone	2.5	58.1	0.8	112 ul	187 ul	0.6	0.8
Acetonitrile	3.0	41.1	0.8	96 ul	160 ul	0.7	0.9
Acrylonitrile	3.0	53.1	0.8	120 ul	201 ul	0.8	1.1
Amyl Acetate	1.1	130.2	0.9	100 ul	167 ul	0.3	0.4
Benzene	1.2	78.1	0.9	65 ul	109 ul	0.6	0.8
Butyl Acetate	1.7	116.2	0.9	137 ul	228 ul	0.5	0.7
Butyl Alcohol (1- Butanol)	1.4	74.1	0.8	78 ul	131 ul	0.4	0.5
sec-Butyl Alcohol (2-Butanol)	1.7	74.1	0.8	95 ul	159 ul	0.4	0.5
tert- Butyl Alcohol	2.4	74.1	0.8	138 ul	231 ul	0.7	1.0
Butyraldehyde	1.9	72.1	0.8	102 ul	171 ul	0.5	0.7
Cyclohexane	1.3	84.2	0.8	86 ul	143 ul	0.6	0.8
Diethyl Ketone (3-Pentanone)	1.6	86.1	0.8	103 ul	173 ul	0.5	0.7
p-Dioxane	2.0	88.1	1.0	104 ul	174 ul	0.5	0.6
Ethanol (Ethyl Alcohol)	3.3	46.1	0.8	118 ul	198 ul	0.7	1.0

Ethyl Acetate	2.0	88.1	0.9	119 ul	199 ul	0.6	0.8
Ethyl Amine	3.5	45.1	0.7	140 ul	234 ul	0.5	0.6
Ethyl Benzene	0.8	106.2	0.9	60 ul	100 ul	0.5	0.6
Ethyl Ether	1.9	72.2	0.7	120 ul	200 ul	0.7	0.9
Gasoline	1.4	100.2	0.8	107 ul	179 ul	0.5	0.7
Heptane	1.1	100.2	0.7	94 ul	157 ul	0.5	0.6
Hexane	1.1	86.2	0.7	86 ul	144 ul	0.5	0.6
Isopentane (2-Methylbutane)	1.4	72.2	0.6	99 ul	166 ul	0.6	0.8
Isoprene (2-Methyl-1, 3-Butadiene)	1.5	68.1	0.7	89 ul	149 ul	0.6	0.8
JP-4 (Jet fuel mainly Kerosene)	1.3	184.4	0.8	183 ul	306 ul	0.3	0.4
Methanol (Methyl Alcohol)	6.0	32.0	0.8	148 ul	248 ul	0.8	1.1
Methyl Ethyl Ketone (2-Butanone)	1.4	72.1	0.8	76 ul	128 ul	0.6	0.8
Methyl Methacrylate	1.70	100.1	0.9	111 ul	186 ul	0.6	0.7
Methyl-t-Butyl Ether(MTBE)	1.5	88.2	0.7	109 ul	182 ul	0.6	0.8
Naphtha (Petroleum Ether)	1.1	86.2	0.6	96 ul	161 ul	0.6	0.8
Octane	1.0	114.2	0.7	99 ul	166 ul	0.5	0.6
Pentane	1.5	72.2	0.6	105 ul	176 ul	0.6	0.8
2-Propanol (Isopropyl Alcohol)	2.0	60.1	0.8	93 ul	156 ul	0.6	0.8
Propanol (Propyl Alcohol)	2.2	60.1	0.8	100 ul	168 ul	0.6	0.7
Propylacetate	1.7	102.1	1.0	106 ul	177 ul	0.5	0.7
Propylamine	2.0	59.1	0.7	103 ul	172 ul	0.6	0.8
Propylene Oxide	2.3	58.1	0.8	98 ul	164 ul	0.7	1.0
Styrene (Vinyl Benzene)	0.9	104.2	0.9	63 ul	105 ul	0.5	0.6
Tetrahydrofuran	2.0	72.1	0.9	99 ul	166 ul	0.7	0.9
1,1,1-Toluene (Methylbenzene, Toluol)	1.1	101.2	0.9	78 ul	131 ul	0.5	0.7
Triethylamine	1.2	101.2	0.7	102 ul	171 ul	0.6	0.8
o-Xylene	0.9	106.2	0.9	68 ul	113 ul	0.4	0.5
p- Xylene	1.1	106.2	0.9	83 ul	139 ul	0.4	0.5
m- Xylene	1.1	106.2	0.9	83 ul	139 ul	0.4	0.5
Xylenes	1.1	106.2	0.9	83 ul	139 ul	0.4	0.5

Table 20: Chemical List from1994 NFPA

9.6 Spare Parts and Accessories

To order spare parts and/or accessories, please contact your nearest General Monitors representative, or General Monitors directly, and give the following information:

- Part Number of Spare Part or Accessory
- Description of Spare Part or Accessory
- Quantity of Spare Part or Accessory

9.6.1 Sensors

10001-1	Standard Industrial Hydrocarbon
10001-1R	Poison Resistant
10014-1	Standard Industrial Hydrocarbon High Temp
10014-1R	Poison Resistant High Temp
10015-1	Standard Industrial Hydrocarbon High Temp Export Version
10022-1	Standard Industrial Hydrocarbon High Temp PTB
10022-1R	Standard Industrial Hydrocarbon High Temp PTB, Poison Resistant
10058-1	Standard Industrial Stainless Steel, Hydrocarbon
10058-1R	Standard Industrial Stainless Steel, Hydrocarbon, Poison Resistant
10391-1	High Temp, Stainless Steel
10391-1R	High Temp, Stainless Steel, Poison Resistant
10387-4	Sensor Assembly, Standard Hydrocarbon, Super Poison Resistant
10164-1	Sensor Assembly, Hydrogen Specific
11159-1L	General Purpose, SST, Sintered Steel Arrestor
11159-2L	General Purpose, SST, High Temp, Sintered Steel Arrestor
10102-1	Dummy Sensor

9.6.2 Sensor Housing

B13-020 or B13-021	Sensor Housing

9.6.3 Sensor Accessories

10460-2	Test Gas Applicator
10041-1	Duct Mounting Plate
10044-1	Dust Guard Kit - 1 Guard, 12 Replaceable Screens
10042-1	Replaceable Screens, Box of 12
10395-1	Splash Guard Assembly
50060-1	H_2S Guard Filter
50061-1	Purafil Insert Assembly
10110-1	Dust Guard Assembly
1800822	Dust Guard, Sintered SST
10066	Flow Block

9.6.4 Calibration Equipment

10543-1	3-Liter Calibration Chamber with 250µL Syringe
928-700	Dish for the 3- Liter Chamber
928-715	250µL microliter syringe
1400150-M	Portable Purge Calibrator, Methane @ 50% LEL
1400150-H	Portable Purge Calibrator, Hydrogen @ 50% LEL
1400150-BD	Portable Purge Calibrator, Butadiene @ 50% LEL
1400150-PR	Portable Purge Calibrator, Propane @ 50% LEL
1400155-M	Replacement Cylinder, Methane @ 50% LEL
1400155-H	Replacement Cylinder, Hydrogen @ 50% LEL

1400155-BD	Replacement Cylinder, Butadiene @ 50% LEL
1400155-PR	Replacement Cylinder, Propane @ 50% LEL

Cylinder refills are available for Methane and Hydrogen only. Replacement cylinders must be ordered for the other gases.

922-009	Pressure Regulator Gauge
1400152-1	Small Calibration Cup
1400154	Large Calibration Cup
925-026	Tubing

9.6.5 Intelligent Transmitter (S4000C) Replacement Parts

31146-1	Control Board Electronics
31151-1	Output Board Electronics
31156-1	Display Board Electronics
31170-1	Enclosure Cover Assembly with Window
31195-2	Enclosure Base Assembly
30060-1	Calibration Magnet
925-5007	Cover Assy. O-Ring

9.6.6 Recommended Spare Parts for One (1) Year

30060-1	Extra Calibration Magnet (Qty. 1)

9.7 FMRC Approval

Factory Mutual Research Corporation

1151 Boston-Providence Turnpike

Norwood, Massachusetts 02062

Approval of the transmitter does not include, or imply, approval of apparatus to which the transmitter may be connected and which processes the electronic signal for the eventual end use. In order to maintain FMRC approved system, the control instrument, to which the subject instrument is connected, must be FMRC approved.

The following sensors have been FMRC approved for use with the Model S4000C:

- 10001-1 Aluminum Body General Purpose Combustible Gas Sensor
- 10058-1 Stainless Steel Body General Purpose Combustible Gas Sensor

The following apparatus have been FMRC approved (although they have not been verified as part of a Model S4000C system):

- Model DC110 Eight Channel Readout/Relay Display Module
- Model DC130 Dual Channel Readout/Relay Display Module

Factory Mutual Research Corporation has tested the Model S4000C according to the criteria listed under the FMRC Approval Standards for Combustible Gas Detectors, Class Numbers 6310 & 6320.

FMRC has tested the Model S4000C using the specifications listed in Section 9.2. This permits an operating temperature of -40°F to +167°F (-40°C to +75°C), a general purpose sensor (10001-1 or 10058-1) attached to the housing (i.e. not remote), calibration performed with a General Monitors' Portable Purge Calibrator using 50% LEL gas (Methane, Hydrogen, Butadiene, Butane, Ethane or Propane) and the procedure listed in Section 4.5. The conduit containing wires connected to the relay contacts must be sealed. If the non-latching relay option has been selected from the relay options, the user must provide alternate means of latching the relay output.

ADDENDUM
Product Disposal Considerations

This product may contain hazardous and/or toxic substances.

EU Member states shall dispose according to WEEE regulations. For further General Monitors' product WEEE disposal information please visit:
www.generalmonitors.com/customer_support/faq_general.html

All other countries or states: please dispose of in accordance with existing federal, state and local environmental control regulations.

Model S4000T

Intelligent Sensor for Hydrogen Sulfide Gas Detection

The information and technical data disclosed in this document may be used and disseminated only for the purposes and to the extent specifically authorized in writing by General Monitors.

Instruction Manual **0307**

General Monitors reserves the right to change published specifications and designs without prior notice.

Part No. **MANS4000T**
Revision **H/03-07**

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Quick Start Guide

Mounting and Wiring

Tools Required

1. “5mm” Allen head wrench to remove enclosure lid (included with gas detector).
2. Flat-head screwdriver maximum 3/16 in (5 mm) width for terminal block connections (included with gas detector).
3. Adjustable wrench for conduit or cable bgland connections (not included).

The overall and mounting dimensions for the Model S4000T (Figure 1) should be used when making installation determinations.

Information on Class I location seals can be found in the NEC, Article 501-5.

WARNING: Acetic acid will cause damage to metal components, metal hardware, ceramic IC’s, etc. If damage results from the use of a sealant that outgases acetic acid (RTV silicone), the warranty will be void.

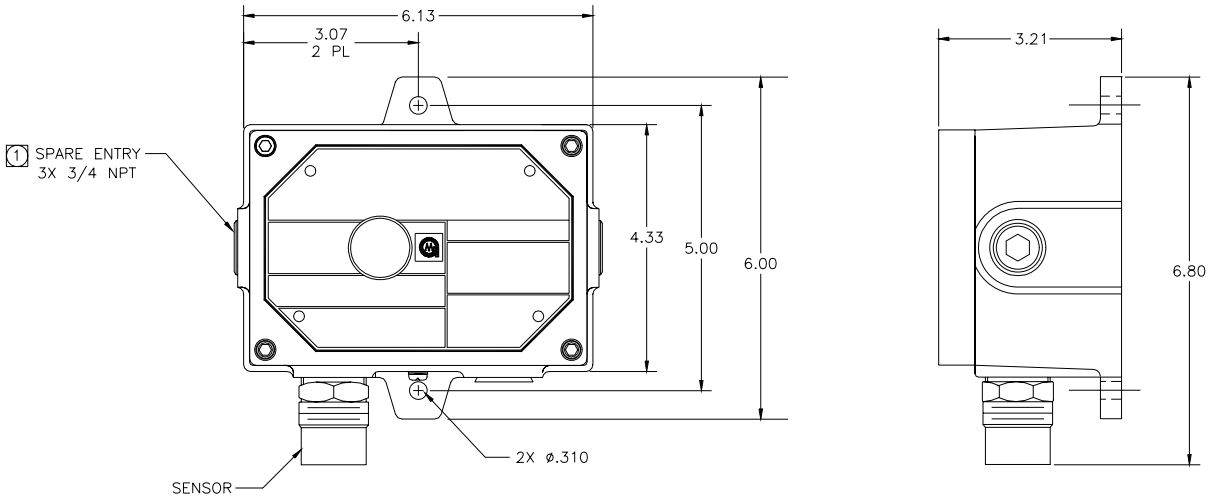

Figure 1: S4000T Outline and Mounting Dimensions

Terminal Connections

The terminal blocks (TB) are located inside the housing and can by accessed by removing the cover. A label on the inside of the housing cover provides details of all the terminal connections.

It is recommended that a three-wire (red, black, white) shielded cable be used for making power and output signal connections on the Model S4000C. The Spring Type terminal block accepts 14 AWG to 20 AWG and the Screw Type terminal block accepts 12 AWG to 18 AWG stranded or solid wire. Each wire should be stripped before wiring the Model S4000C Intelligent Sensor. To connect wiring to the Spring Type terminal block, insert a screwdriver into the

orange tab and press down (Figure 2), opening the terminal. Insert the wire into the terminal and release the orange tab, clamping the wire in the terminal. Check the hold of the wire by GENTLY tugging it to ensure it is locked in.

To connect wiring to the Screw Type terminal block, (Figure 3) use a screwdriver to loosen the top screw counter clock wise. Insert the wire into the terminal and tighten the top screw clock wise. Check the hold of the wire by GENTLY tugging it to ensure it is locked in.

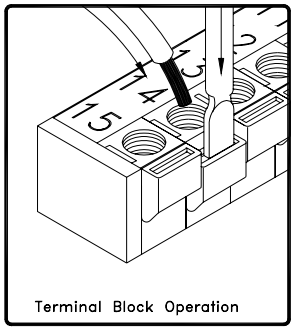

Figure 2: Spring Type Terminal Block Operation

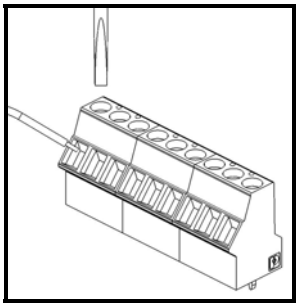

Figure 3: Screw Type Terminal Block Operation

NOTE: Power must remain disconnected until all other wiring connections have been made.

The maximum distance between the Model S4000T and the power supply is 2000 feet or 610 meters (each cable run should be as short as possible). See Section 9.2.3 for cable length specifications. Connect +24VDC to TB2, position 9. Connect the ground or common wire to TB2, position 8. For making power and ground connections to display devices see Figures 2 and 3.

The instrument is now ready to operate. Please consult the manual for more information on the instrument's many features.

NOTE: If you have any problems in the set-up or testing of the detector, please refer to the "Trouble Shooting Section", or call the factory direct.

Worldwide service is available by calling:

Lake Forest, California (24 hr. service)	Toll Free: +1-800-446-4872 Phone: +1-949-581-4464 Fax: +1-949-581-1151
Houston, Texas	Phone: +1-281-855-6000 Fax: +1-281-855-3290
Ireland	Phone: +353-91-751175 Fax: +353-91-751317
Singapore	Phone: +65-6748-3488 Fax: +65-6748-1911
United Arab Emirates	Phone: +971-4-8815751 Fax: +971-4-8817927
United Kingdom	Phone: +44-1625-619583 Fax: +44-1625-619098

1.0 Introduction

1.1 Protection for Life

General Monitors' mission is to benefit society by providing solutions through industry leading safety products, services, and systems that save lives and protect capital resources from the dangers of hazardous flames, gases, and vapors.

This manual provides instruction for installing and operating General Monitors' Model S4000T for Hydrogen Sulfide Gas Detection. While the S4000T is easy to install and operate, this manual should be read in full and the information contained herein understood before attempting to place the system in service.

The safety products you have purchased should be handled carefully and installed, calibrated, and maintained in accordance with the respective product instruction manual. Remember these products are for your safety.

1.2 Special Warnings

The Model S4000T Intelligent Sensor contains components, which can be damaged by static electricity. Special care must be taken when wiring the system to ensure that only the connection points are touched.

Hydrogen Sulfide (H_2S) is an extremely toxic gas, and exposure may result in a loss of consciousness or death.

1.3 System Integrity Verification

To ensure operation at optimum performance, General Monitors recommends that certain maintenance items be performed.

Commissioning Safety Systems

Before power-up, verify wiring, terminal connections and stability of mounting for all integral safety equipment including, but not limited to:

- Power supplies
- Control modules
- Field detection devices
- Signaling / output devices
- Accessories connected to field and signaling devices

After the initial application of power (and any factory specified warm-up period) to the safety system, verify that all signal outputs, to and from devices and modules, are within the manufacturers' specifications. Initial calibration / calibration checking / testing should be performed per the manufacturer's recommendations and instructions.

Proper system operation should be verified by performing a full, functional test of all component devices of the safety system, ensuring that the proper levels of alarming occur.

Fault/Malfunction circuit operation should be verified.

Periodic Testing/Calibration of Field Devices

Periodic testing/calibrating should be performed per the manufacturer's recommendations and instructions. Testing/Calibrating procedures should include, but not be limited to:

- Verify zero reading
- Apply a known concentration of gas, and verify accuracy
- Verify integrity of all optical surfaces and devices
- For flame detectors, use the appropriate test lamp

When testing produces results outside of the manufacturer's specifications, re-calibration or repair/replacement of the suspect device(s) should be performed as necessary. Calibration intervals should be independently established through a documented procedure, including a calibration log, maintained by plant personnel or third party testing services.

Periodic System Verification

The following system verifications should be performed at least annually:

Verify wiring, terminal connections and stability of mounting for all integral safety equipment including, but not limited to:

- Power supplies
- Control modules
- Field detection devices
- Signaling / output devices
- Accessories connected to field and signaling devices

Calibration intervals should be independently established through a documented procedure, including a calibration log maintained by plant personnel or third party testing services.

2.0 Product Description

2.1 General Description

The Model S4000T is an intelligent sensor for the detection of Hydrogen Sulfide (H_2S) gas. The microprocessor-based electronics process information at the sensor site, within an explosion-proof housing.

A digital display provides indications and display codes that can be viewed through a window in the cover. A red LED above the digital display signifies an ALARM condition, while a red LED below the digital display signifies a WARN condition. Analog signal (4-20mA) optional Dual Redundant MODBUS communications and relays, provide remote and/or discrete indications of the sensor's operation.
The Model S4000T Intelligent Sensor is rated explosion-proof for use in the following hazardous areas:

- CSA/FM: Class I, Division 1, Groups B, C, D and Class I, Zone 1, Ex d IIB+H_2, T6
- ATEX: EEx d IIB T6 (Tamb=-40°C to +40°C)

INTELLIGENT SENSOR, H2S GAS
MODEL S4000T
P/N 31180 –
GENERAL MONITORS
GALWAY, IRELAND
LAKE FOREST, CALIFORNIA, USA
EExd IIB T6 (Tamb = - 40° C to +40° C)
EExd IIB T5 (Tamb = - 40° C to +70° C)
Use cable with insulation rated to at least 110° C
S.C.S. Ex 98E1012X
RATED 24 VDC , "⎓" 7 W MAX. , CONTACT RATINGS : SEE MANUAL
CALIBRATION PROCEDURE
1 APPLY MAGNET AND WAIT FOR "AC" ON DISPLAY.
2 APPLY 50% OF FULL SCALE CALIBRATION GAS.
3 UNIT WILL DISPLAY "CP" AFTER A SHORT PERIOD
4 WAIT FOR "CC" TO INDICATE CALIBRATION COMPLETE.
5 REMOVE THE CALIBRATION GAS AND UNIT WILL REVERT TO NORMAL OPERATION.
0
CLASS I, DIV. 1
GROUPS B, C & D
TYPE 4X
FM APPROVED
CAUTION: DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT. DO NOT OPEN WHILE ENERGIZED. READ AND UNDERSTAND INSTRUCTION MANUAL BEFORE OPERATING OR SERVICING.
CSA Approved with H2S SENSOR: 50445-1, 50445-5, 50445-9, 50448-1, 50448-5, 50448-9.
THIS INSTRUMENT EMPLOYS A H2S GAS SENSOR COVERED BY:
CERTIFICATE
S/N
CONFIG
MAN

Figure 4: Model S4000T Intelligent Sensor

3.0 Installation

3.1 Receipt of Equipment

All equipment shipped by General Monitors is pre-packed in shock absorbing containers, which provide protection against physical damage (original containers should be kept for future shipping or storage needs).

Shipping container contents should be carefully removed and checked against the packing list. If any damage has occurred or there is any discrepancy in the order, please notify General Monitors as soon as possible.

All correspondence with General Monitors must specify the equipment part number and serial number.

The factory tests each unit; however, a complete system checkout is suggested upon initial installation to ensure system integrity.

WARNING: Installation and maintenance must be carried out by suitably skilled and competent personnel only.

WARNING: The Model S4000T Intelligent Sensor contains components, which can be damaged by static electricity. Special care must be taken when wiring the system to ensure that only the connection points are touched.

3.2 Tools Required

1. “5mm” Allen head wrench to remove enclosure lid (included with gas detector).
2. Flat-head screwdriver maximum 3/16 in (5 mm) width for terminal block connections (included with gas detector).
3. Adjustable wrench for conduit or cable gland connections (not included).

3.3 Choosing Product Locations

There are no standard rules for sensor placement, since the optimum sensor location is different for each application. The customer must evaluate conditions at the facility to make this determination. Generally, the Model S4000T Intelligent Sensor should be easily accessible for calibration checks.

- The transmitter should be mounted pointing down to prevent water build-up on the sensor head.
- The transmitter should not be placed where contaminating substances may coat it.
- Although the Model S4000T is RFI resistant, it should not be mounted in close proximity to radio transmitters or similar equipment.
- Locate the Model S4000T where prevailing air currents contain the maximum concentration of gas.

- Locate the Model S4000T near possible sources of gas leaks.
- Observe the Model S4000T's temperature specification and locate the unit away from concentrated sources of heat.
- Transmitters should be mounted in an area that is as free from wind, dust, water, shock, and vibration as possible. See Section 9.3.4 for the environmental specifications of the unit. If dust and rain cannot be avoided, we recommend the use of our splash guard (GM P/N 10395-1).

Sensors may be adversely affected by prolonged exposure to certain materials. Loss of sensitivity or corrosion may be gradual if such materials are present in low concentrations, or it may be rapid at high concentrations. The more important materials adversely affecting sensors are:

- Silicones (often contained in greases and aerosols)
- Halides: compounds containing Fluorine, Chlorine, Bromine and Iodine
- Heavy metals, e.g. Tetraethyl Lead
- Caustic and Acidic liquids and vapors
- Glycol

The presence of contaminants in an area does not necessarily preclude the use of a Model S4000T Intelligent Sensor. The feasibility of using a sensor in such areas must be determined by an analysis of the specific factors in each application, and General Monitors should be consulted before attempting any such installation.

Sensors used in these areas usually require more frequent calibration checks than normal, and typically have a shorter life. In many such applications the standard two-year warranty would not apply.

IMPORTANT: Each H_2S Sensor is shipped with a red plastic cap fitted over the sensor head. Inside the cap is a desiccant. DO NOT remove this cap until you are ready to power the system. SAVE the cap and RE-CAP the sensor anytime the system power is off for more than one hour.

WARNING: General Monitors discourages the painting of sensor assemblies. If the sensor head is painted over, the gas will not be able to diffuse into the sensor. If the assembly cover is painted over, the digital display cannot be read.

3.3.1 Remote Mounting of the Sensor from the Electronics

If it is necessary to remotely mount the sensor from the electronics and the housing, the maximum distance can be no greater than 3700 feet (1125) meters, using 14 AWG wire. Sensors that are remotely mounted, must be placed in an explosion-proof rated sensor housing (GM P/N 10252-1), and the cable run must be contained in a conduit running from the sensor housing to the electronics. See Section 9.6, for FMRC approval requirements.

3.4 Mounting and Wiring

WARNING: The conduit entries should be sealed per the NEC 500-3d, or Canadian Electrical Code Handbook (Part 1, Section 18-154). Additional benefit of conduit seals is the prevention of water entering the housing through the conduit entry.

WARNING: Unused cable entry holes must be sealed with an approved explosion-proof plug. Red caps supplied by General Monitors are for dust protection only and must not be left on the unit when installed.

The overall and mounting dimensions for the Model S4000T (Figure 5) should be used when making installation determinations. A complete list of the mechanical specifications can be found in Section 9.3.2.

To prevent possible corrosion due to moisture or condensation, it is recommended that the conduit connected to the Model S4000T housing be sealed, or contain a drain loop.

Each conduit run from a hazardous location to a non-hazardous location should be sealed so that gases, vapors, and/or flames cannot pass beyond the seal. The purpose of seals in a Class I hazardous location, is to prevent the passage of gases, vapors, or flames from one electrical installation to another, through the conduit system. It is not necessary to seal the Model S4000T housing to maintain its explosion-proof integrity; however, conduit runs containing wires attached to the Model S4000T's relay contacts must be sealed (Section 3.5).

Information on Class I location seals can be found in the NEC, Article 501-5.

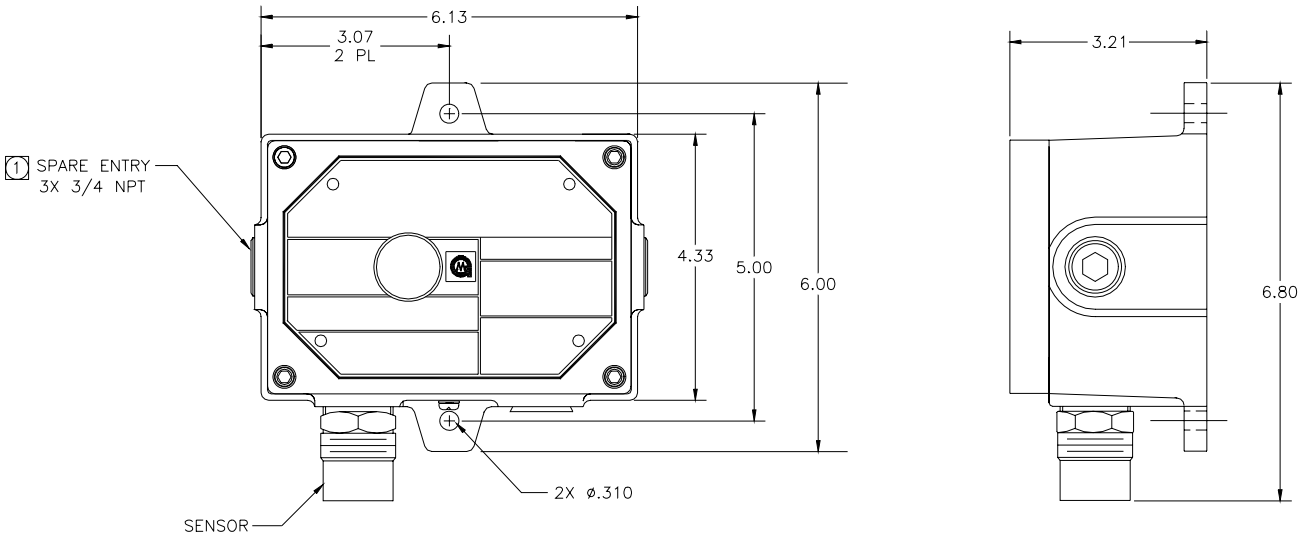

Figure 5: S4000T Outline and Mounting Dimensions

WARNING: Acetic acid will cause damage to metal components, metal hardware, ceramic IC's, etc. If damage results from the use of a sealant that outgases acetic acid (RTV silicone), the warranty will be void.

Once correctly installed, the Model S4000T requires little or no maintenance, other than periodic calibration checks to ensure system integrity. General Monitors recommends that a schedule be established and followed.

NOTE: The system's full two-year warranty will be voided if customer personnel or third parties damage the system during repair attempts.

Sensor heads exposed to the elements may require the accessory mounting threads to be lubricated. Grease must not be used. As an alternate, PTFE (Teflon) tape may be used on sensor accessory threads.

NOTE: Do not use any material or substance on threads that contact the sensor housing.

The removal of particulate matter from sensor accessories may be done through the use of an appropriate halogen-free solvent. Water and/or ethanol are examples of suitable solvents. The accessories should be thoroughly dried, with compressed air if necessary, before refitting to the sensor body.

3.5 Terminal Connections

The terminal blocks (TB) are located inside of the housing and can by accessed by removing the cover. A label on the inside of the housing cover provides details of all the terminal connections.

3.5.1 Terminal Block TB1 – Sensor Connections

TB1 contains the four sensor connections, white (W), black (B), red (R) and green (G). Remove the display board by loosening the two captive screws on the board and lifting it straight up. Connect the color-coded wires from the sensor to the matching colored terminals on TB1. The label on the inside of the cover can serve as a guide. Replace the display board, by pressing it into place, and tightening the two captive screws.

WARNING: Do not connect +24VDC to TB1. Damage to the electronics or sensor may result.

3.5.2 Terminal Block TB2 – Power and Signal Connections

TB2 contains the connections for Power, Relay Reset, Remote Calibration, MODBUS and 0-20mA Output Signal. The terminal connections are as follows:

TB2 position	Function
1	0-20mA Output
2	CH1 MODBUS -
3	CH1 MODBUS +
4	CH2 MODBUS -
5	CH2 MODBUS +
6	Remote Calibration
7	Relay Reset
8	Ground
9	+24VDC Power

Table 1: TB2 Power and Signal Connections

It is recommended that a three-wire (red, black, white) shielded cable be used for making power and output signal connections on the Model S4000C. The Spring Type terminal block accepts 14 AWG to 20 AWG and the Screw Type terminal block accepts 12 AWG to 18 AWG stranded or solid wire. Each wire should be stripped before wiring the Model S4000C Intelligent Sensor. To connect wiring to the Spring Type terminal block, insert a screwdriver into the orange tab and press down (Figure 6), opening the terminal. Insert the wire into the terminal and release the orange tab, clamping the wire in the terminal. Check the hold of the wire by GENTLY tugging it to ensure it is locked in.

To connect wiring to the Screw Type terminal block, (Figure 7) use a screwdriver to loosen the top screw counter clock wise. Insert the wire into the terminal and tighten the top screw clock wise. Check the hold of the wire by GENTLY tugging it to ensure it is locked in.

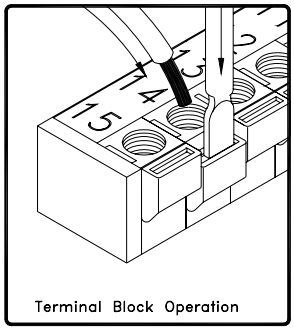

Figure 6: Spring Type Terminal Block Operation

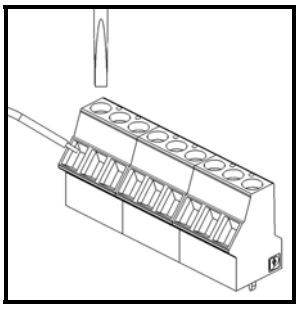

Figure 7: Screw Type Terminal Block Operation

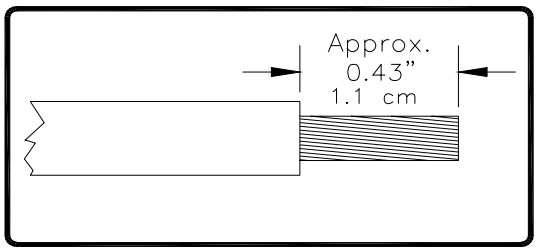

Figure 8: Wire Strip Length

NOTE: Up to 12 AWG wire can be used if it is carefully stripped (on a Screw Type terminal only-Figure 8).

3.5.3 DC Power and Ground Connections

The customer must provide Primary DC power, unless one of the following General Monitors' Modules is being used with the Model S4000T:

- DT230 Dual-Channel Readout/Relay Display Module
- TA202A Trip Amplifier Module with a PS002 Power Supply & Relay Module

The following General Monitors' Modules provide power connections for the Model S4000T, but need a customer supplied DC source:

- DT210 Eight-Channel Readout/Relay Display Module
- TA202A Trip Amplifier Module without a PS002

Since the Model S4000T is designed to operate continuously, a power switch is not included, in order to prevent accidental system shutdown.

NOTE: Power must remain disconnected until all other wiring connections have been made.

The maximum distance between the Model S4000T and the power supply is 2000 feet or 610 meters (each cable run should be as short as possible). See Section 9.3.3 for cable length specifications. Connect +24VDC to TB2, position 9. Connect the ground or common wire to TB2, position 8. For making power and ground connections to display devices see Table 2 and Table 3.

FROM	TO		
Model S4000T	Model DT210	Model DT230	Model TA202A
TB2-8 "COM"	Rear COMMON	Rear Pin 3 or 6 "COM"	Rear Pin 30d or 30z

Table 2: Ground or Common Connections

FROM	TO		
Model S4000T	Model DT210	Model DT230	Model TA202A
TB2-9 "+24 VDC"	Rear CH 1 - 8 24V	Rear Pin 4 or 7 "DC OUT"	Rear Pin 28d or 28z

Table 3: Power Connections

3.5.4 Analog Signal Connections

The Model S4000T Intelligent Transmitter provides a 4 to 20mA output signal. This signal can be sent up to 9000 feet (2740 meters) to:

- A General Monitors readout/relay display module, or
- An industrial analog to digital converter, or
- A computer-based monitor,
- A PLC, or
- A DCS.

The 4 to 20mA signal provides for control room or other locations remote to the Model S4000T to display indications of operation and alarm conditions. To connect the 4 to 20mA output signal with another unit, connect the wire into TB2, position 1, labeled 4-20mA OUT. For making output signal connections to display devices, refer to the specific manual for that device (Table 4).

FROM	TO		
Model S4000T	Model DT210	Model DT230	Model TA202A
TB2-1 4-20mA Output	Rear CH 1 – 8 4-20mA	Rear Pin 2 or 5 Analog In	Rear Pin 26d or 26z

Table 4: Analog Signal Connections

If a device other than a General Monitors readout/relay display module is being used, the DC ground, COM, of both systems must be connected together.

3.5.5 Terminal Block TB3 – Relay Connections

TB3 contains the connections for the Relay Contacts (optional). The function for the Warn and Alarm Relay connections vary, according to the normal state of the relay. Use the following as a guide for determining the Normally Open (**NO**) and the Normally Closed (**NC**) contact:

TB3 position	Relay Contact (De-Energized)	Relay Contact (Energized)
1	Normally Closed	Normally Open
2	Common	Common
3	Normally Open	Normally Closed

Table 5: Alarm Relay Connections

TB3 position	Relay Contact (De-Energized)	Relay Contact (Energized)
4	Normally Closed	Normally Open
5	Common	Common
6	Normally Open	Normally Closed

Table 6: Warn Relay Connections

TB3 position	Relay Contact (Energized)
7	Normally Open
8	Common
9	Normally Closed

Table 7: Fault Relay Connections

***NOTE:** Fault relay is normally energized. Relay will change state after power up.

WARNING: Contact with PCB components should be avoided to prevent damage by static electricity. All wire connections are made to the Terminal Blocks.

WARNING: Relay contacts must be protected against transient and over voltage conditions (Figure 9).

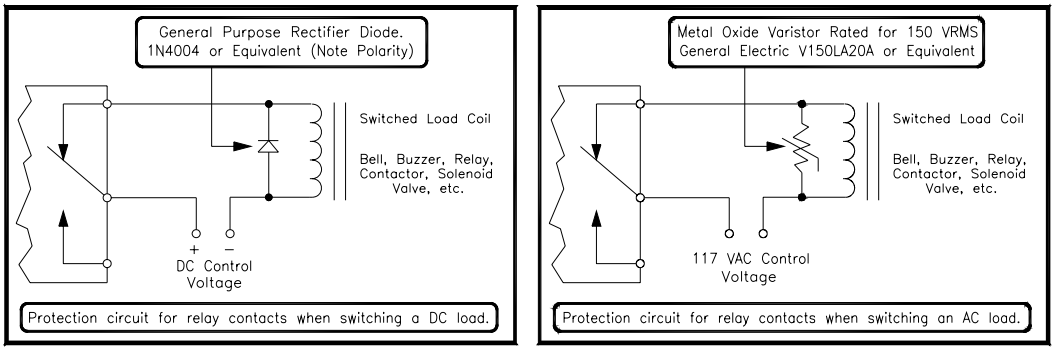
General Purpose Rectifier Diode.
1N4004 or Equivalent (Note Polarity)
Switched Load Coil
Bell, Buzzer, Relay, Contactor, Solenoid Valve, etc.
+
–
DC Control Voltage
Protection circuit for relay contacts when switching a DC load.
Metal Oxide Varistor Rated for 150 VRMS
General Electric V150LA20A or Equivalent
Switched Load Coil
Bell, Buzzer, Relay, Contactor, Solenoid Valve, etc.
117 VAC Control Voltage
Protection circuit for relay contacts when switching an AC load.

Figure 9: Relay Protection for DC and AC Loads

North American Approved Applications - The ALARM relay contact ratings are 8A @ 250 VAC and 8A @ 30 VDC resistive max.

European Union (EU) Approved Applications - The ALARM relay contact ratings are 8A, 30 V RMS/42.4 V peak or 8A @ 30 VDC resistive max.

3.5.6 European Union (EU) Approved Applications

Interconnecting cables must have an overall screen, or screen and armor. Cables BS5308 Part 2, Type 2, or equivalent are suitable.

NOTE: The terms 'screen' and 'shield' are equivalent for the purpose of this manual. The cable armor must be terminated in a suitable cable gland at the detector, to ensure a positive electrical connection.

3.5.7 Cable termination in the non-hazardous area

- The cable **armor** must be connected to **safety earth** in the safe area.
- The cable **screen** (drain wire) must be connected to an **instrument earth** in the safe area.

- The power supply **OV return** must be connected to an **instrument earth** in the safe area.
- The interconnecting cables should be segregated from power and other noisy cables. Avoid proximity to cables associated with radio transmitters, welders, switch mode power supplies, inverters, battery chargers, ignition systems, generators, switch gear, arc lights and other high frequency or high power switching process equipment. In general, maintain separation of at least 1 meter between instrument and other cables. Greater separations are required where long parallel cable runs are unavoidable. Avoid running instrument cable trenches close to lightning conductor earthing pits.
- Complete all cable insulation testing before connecting the cable at either end.

WARNING: Under **NO** circumstances should equipment be connected or disconnected when under power. This is contrary to hazardous area regulations and may lead to serious damage to the equipment. Equipment damaged in this manner is not covered under warranty.

3.6 Maintaining the X/P Integrity

The Model S4000T is rated explosion-proof for the following hazardous locations:

- CSA/FM: Class I, Division 1, Groups B, C, D and Class I, Zone 1, Ex d IIB+H_2, T6 and
- ATEX: EEx d IIB T6 (Tamb=-40°C to +40°C)

Some of the factors that influence the explosion-proof integrity of the Model S4000T housing are:

- Strength of the enclosure material
- Thickness of the enclosure walls
- Flame path between the housing and cover
- Flame path of threaded joints

The acceptable limits for explosion-proof housings that are used in Class I hazardous locations are defined in CSA Standard C22.2 No.30-M1986, FM 3615 and EN50014.

Anytime the cover of the Model S4000T housing is removed or the cover bolts are loosened, the flame path between the lid and the housing is affected. If power is to be left on while removing the cover or loosening the cover bolts on the Model S4000T, it will be necessary to declassify the area.

When replacing the cover, the gap between the lid and the housing should be less than .0015 inch (.038 mm). Make sure that the flame path is clear of dirt and debris before replacing the cover. This can be verified by tightening the cover bolts to a torque setting of 50 inch-pounds or by using a feeler gauge to ensure the gap between the cover and the housing is less than .0015 inch (.038 mm).

There are four entry holes, one each on the left and right sides, and two on the bottom of the Model S4000T housing. These holes are dedicated for the sensor, the reset switch and conduit. Each hole is tapped for ¾" NPT threads. If a particular entry hole is not used, it must be

plugged during operation in the field. The factory installs plugs in the unused entry holes, except one. A red plastic cap is placed into the remaining hole and must be removed before conduit can be attached to the housing.

The Model S4000T will have the following items placed in the three remaining entry holes, at the factory:

- A sensor, if present (otherwise a red plastic cap)
- A reset switch, if present (otherwise an aluminum housing plug – optional)
- An aluminum housing plug

The sensor, reset switch and aluminum-housing plug have seven threads. Each of these components is screwed into the housing using five to seven turns. If it becomes necessary to replace the sensor, reset switch and/or the aluminum-housing plug, the user must use five to seven turns to ensure the explosion-proof integrity of the housing is maintained.

4.0 Operation

4.1 Start-Up Checklist

Prior to starting the system, verify the following:

1. Inhibit any external devices, such as Trip Amplifiers, PLC's, or DCS systems.
2. Verify that the optional settings are set for the desired configuration.
3. Verify that the unit is properly mounted. Ensure the conduit/cable gland entries are pointed downward.
4. Verify that the signal wiring is correct.
5. Verify that the power supply is connected properly. The Model S4000T is powered by +24VDC (20 to 36 VDC voltage range). The detector will output a low voltage fault (F6) at 18.5 VDC or below.
6. Make sure the lid is securely installed or the area has been de-classified.

4.2 Start-Up

Before applying power to the system for the first time, all wiring connections should be checked for correctness and the housing cover replaced. Upon first power-up, the sensor may take up to fifteen minutes to stabilize.

At the initial application of power, the unit will test all of the LED segments by displaying "**88.8**". The software revision letter will then be displayed for a few seconds. The unit will then enter Operational Mode and the current gas concentration at the sensor will be displayed. For details of Calibrating and Gas Checking the unit, see Sections 4.5 and 4.6.

4.3 Relay Reset

If the Warn and Alarm relays are configured as latching, they must be manually reset, after an alarm occurs. This can be accomplished by three different methods:

1. The relays can be reset via the MODBUS Interface (Section 8.8.15).
2. The relays can be reset via the magnetic switch using a magnet. Place the magnet over the GM Logo on the cover of the unit. After three seconds the display will show "rSt". Remove the magnet at this time and the relays will be reset (Figure 10).

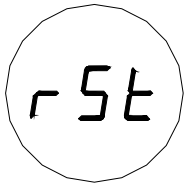

Figure 10: Relay Reset

3. The relays can be reset via the Remote Reset input terminals on TB2. Connect a normally open switch between terminal TB2-7 and TB2-8. Closing the switch momentarily will reset the relays. General Monitors explosion-proof switch, P/N 30051-1 can be used for this purpose. See Section 9.5 for ordering instructions.

NOTE: Red LED's above and below the digital display indicate that the Alarm and Warn relays are active. Latching relays can only be reset if the gas concentration has fallen below the respective relay set point.

4.4 User Selectable Options

The Model S4000T Intelligent Sensor includes many selectable options to provide the user with the most flexible H_2S gas detector possible. These options include Selectable Sensor Range, Warn and Alarm Relay Set Points and Configuration, and MODBUS Communications Settings. These allow the unit to operate with a wide variety of PLC and DCS Systems. The following sections explain the available options and how they can be customized.

A flow diagram is included to help the user in understanding the process of reviewing and changing the available options (Figure 11).

NOTE: If the unit was ordered without relays or MODBUS communications, changing the relay or MODBUS settings will have no effect on the operation of the unit.

4.4.1 Model S4000T User Menu Structure

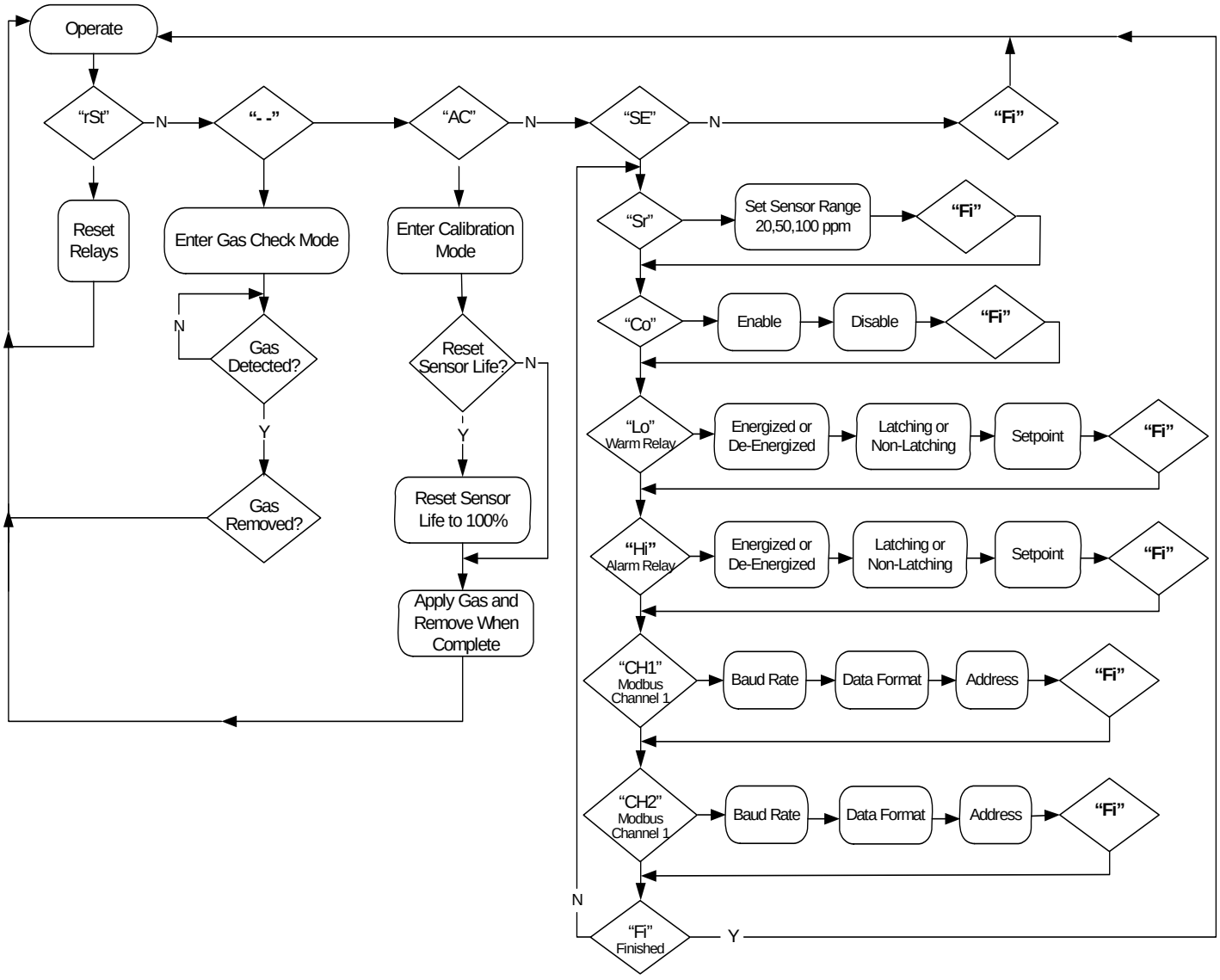

Figure 11: User Menu Structure

NOTE: "Co" represents Calibration Output. When "Co" is enabled and calibration is successful, the analog output goes from 1.5 mA to 3.2 mA for 5 seconds, settling at the desired value of 4mA.

4.4.2 Sensor Range

The Sensor Range is selectable between 0-20ppm, 0-50ppm, or 0-100ppm depending on the installed sensor. To adjust the Sensor Range of the Model S4000T, apply the magnet to the GM Logo on the cover of the unit until "**SE**" is displayed, then remove the magnet. This puts the unit into Setup Mode. After a few seconds "**Sr**" will be displayed. Apply and remove the magnet to adjust the Sensor Range. The current Sensor Range will be displayed. To change the sensor

range, apply and remove the magnet repeatedly, until the desired range is displayed. Once the desired range is displayed, wait 3 seconds and "**Fi**" will be displayed. Apply and remove the magnet, to return to the next level of the Setup menu. When "**Fi**" is displayed again, apply and remove the magnet to return to normal operation.

NOTE: When the Sensor Range is changed, the Warning and Alarm set points are automatically scaled to the new range. The unit must now be calibrated to the new range (Section 4.6.1).

4.4.3 Warning Relay Settings

To adjust the Warning Relay Settings of the Model S4000T, apply the magnet to the GM Logo on the cover of the unit until "**SE**" is displayed, then remove the magnet. This puts the unit into Setup Mode. After a few seconds "**Lo**" will be displayed. Apply and remove the magnet to change the Warning or "Low" alarm settings.

First, the Energized/De-Energized state of the relay is displayed by either "**En**" or "**dE**" being displayed respectively. Apply and remove the magnet until the desired state is displayed.

After a few seconds the Latching/Non-Latching state of the relay is displayed by either "**La**" or "**nL**". Apply and remove the magnet until the desired state is displayed.

After a few seconds, the current Warning relay set point is displayed. Apply and remove the magnet until the desired set point is displayed. Once the desired set point value is displayed, wait 3 seconds and "**Fi**" will be displayed. Apply and remove the magnet to return to the next level of the Setup menu. When "**Fi**" is displayed again, apply and remove the magnet to return to normal operation.

The default Warning relay settings are: non-latching, de-energized, 30% FS set point. The maximum allowable set point is 50ppm.

NOTE: The Warn Relay set point cannot be set higher than the Alarm Relay set point.

4.4.4 Alarm Relay Settings

To adjust the Alarm Relay Settings of the Model S4000T, apply the magnet to the GM Logo on the cover of the unit until "**SE**" is displayed, then remove the magnet. This puts the unit into Setup Mode. After a few seconds "**Hi**" will be displayed. Apply and remove the magnet, to change the Alarm or "High" alarm settings.

First, the Energized/De-Energized state of the relay is displayed by either "**En**" or "**dE**" being displayed respectively. Apply and remove the magnet, until the desired state is displayed.

After a few seconds the Latching/Non-Latching state of the relay is displayed by either "**La**" or "**nL**". Apply and remove the magnet, until the desired state is displayed.

After a few seconds the current Alarm relay set point is displayed. Apply and remove the magnet until the desired set point is displayed. Once the desired set point value is displayed, wait 3 seconds and "**Fi**" will be displayed. Apply and remove the magnet to return to the next level of the Setup menu. When "**Fi**" is displayed again, apply and remove the magnet, to return to normal operation.

The default Alarm relay settings are: latching, de-energized, 60% FS set point.

NOTE: The Alarm Relay set point cannot be set lower than the Warning Relay set point.

4.4.5 MODBUS Channel 1 Settings

To adjust the MODBUS Channel 1 settings of the Model S4000T, apply the magnet to the GM Logo on the cover of the unit until "**SE**" is displayed, then remove the magnet. This puts the unit into Setup Mode. After a few seconds "**CH1**" will be displayed. Apply and remove the magnet, to change the MODBUS Channel 1 settings.

First, the current Baud Rate MODBUS Channel 1 is displayed. If another baud rate is to be selected, apply and remove the magnet until the desired baud rate is displayed. The choices are: 19.2k baud "**19.2**", 9600 baud "**96**", 4800 baud "**48**", or 2400 baud "**24**".

After a few seconds, the current Data Format for MODBUS Channel 1 is displayed. If another data format is to be selected, apply and remove the magnet until the desired data format is displayed. The choices are: 8-N-1 "**8n1**", 8-N-2 "**8n2**", 8-E-1 "**8E1**", or 8-O-1 "**8O1**".

After a few seconds, the current address for MODBUS Channel 1 is displayed. Apply and remove the magnet until the desired address is displayed. Once the desired address is displayed, wait 3 seconds and "**Fi**" will be displayed. Apply and remove the magnet, to return to the next level of the Setup menu. When "**Fi**" is displayed again, apply and remove the magnet, to return to normal operation.

Default settings for Channel 1 are: address 1, 19.2k baud, 8-N-1.

NOTE: The address can be adjusted from 1 - 247. Channel 1 and Channel 2 addresses may be the same.

4.4.6 MODBUS Channel 2 Settings

To adjust the MODBUS Channel 2 Settings of the Model S4000T, apply the magnet to the GM Logo on the cover of the unit until "**SE**" is displayed, then remove the magnet. This puts the unit into Setup Mode. After a few seconds "**CH2**" will be displayed. Apply and remove the magnet to change the MODBUS Channel 2 settings.

First, the current Baud Rate MODBUS Channel 2 is displayed. If another baud rate is to be selected, apply and remove the magnet until the desired baud rate is displayed. The choices are: 19.2k baud "**19.2**", 9600 baud "**96**", 4800 baud "**48**", or 2400 baud "**24**".

After a few seconds, the current Data Format for MODBUS Channel 2 is displayed. If another data format is to be selected, apply and remove the magnet until the desired data format is displayed. The choices are: 8-N-1 "**8n1**", 8-N-2 "**8n2**", 8-E-1 "**8E1**", or 8-O-1 "**8O1**".

After a few seconds, the current address for MODBUS Channel 2 is displayed. Apply and remove the magnet until the desired address is displayed. Once the desired address is displayed, wait 3 seconds and "**Fi**" will be displayed. Apply and remove the magnet to return to the next level of the Setup menu. When "**Fi**" is displayed again, apply and remove the magnet to return to normal operation.

Default settings for Channel 2 are: address 2, 19.2 kbaud, 8-N-1.

NOTE: The address can be adjusted from 1 - 247. Channel 1 and Channel 2 addresses may be the same.

4.5 Gas Check Mode

The sensor's response can be checked without activating external alarms by placing the Model S4000T in Gas Check Mode. In this mode, the alarm relays are inhibited and the analog output is fixed at 1.5mA.

4.5.1 Procedure for Checking the Calibration:

Place the magnet over the GM Logo on the cover of the Model S4000T. Remove the magnet when a flashing pair of bars, "**- -**" (Figure 12), appear on the display (about ten seconds). Apply the test gas to the sensor, and the value of the gas concentration will be indicated by the flashing display and should stabilize in one to two minutes.

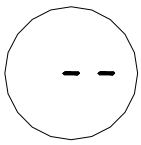

Figure 12: Gas Check

When the reading has stabilized and the test is complete, remove the gas and the unit will return to normal operation, when the concentration drops below 5% full-scale. If, after the reading has stabilized the sensor is to be calibrated, simply apply the magnet to the GM Logo on the housing cover, and the unit will enter Calibration Mode.

Gas Check Mode can be aborted if gas has not been applied to the sensor. Simply reapply the magnet to the GM Logo on the cover and the unit will return to normal operation.

NOTE: The test gas concentration must be at least 10% full-scale before the unit will complete the Gas Check sequence. If the Model S4000T is placed in the Gas Check mode and no gas is applied for twelve minutes, the unit will revert to a Fault condition. Re-applying the magnet over the GM Logo will return the unit to normal operation.

4.6 Calibration

General Monitors recommends that the Model S4000T Intelligent Sensor be calibrated one hour after start-up, and again 24 hours after initial start-up, and that the calibration be checked at least every ninety (90) days, to ensure system integrity. General Monitors is not implying that the customer should expect problems with sensor life or stability, but "frequent" calibration checks merely ensure the integrity of the life protecting equipment.

The above statement is not intended to discourage the customer from checking calibration more frequently. Frequent calibration checks are recommended for environments that have

problems, such as mud collecting on the sensor head, sensors accidentally being painted over, etc.

General Monitors recommends that a calibration schedule be established and followed. A logbook should also be kept showing calibration dates and dates of sensor replacement.

4.6.1 Calibration Procedure

If Hydrogen Sulfide (H_2S) gas is suspected to be present, it will be necessary to purge the sensor environment with clean air.

Entering Calibration Mode automatically disables the alarm circuits by sending a 1.5mA output signal and disabling the Warn and Alarm relays, if present. This will also prevent activation of the remote relay contacts when using a General Monitors Readout/Relay Display Module with the Model S4000T.

To enter Calibration Mode, place the magnet over the GM Logo on the cover of the unit (Figure 4) and hold it there until "**AC**" (Figure 13) appears on the display (about ten seconds). The display will flash the Remaining Sensor Life (Section 4.6.3) for a few seconds. Ensure that the sensor is seeing clean air during this time.

Figure 13: Automatic Calibration Mode

Apply the calibration gas concentration to the sensor (50% FS of the desired range of H_2S). The display will change from "**AC**" (Automatic Calibration) to "**CP**" (Calibration in Progress) indicating that the sensor is responding to the calibration gas (Figure 14).

Figure 14: Calibration in Progress Mode

After three to five minutes, the display will change from "**CP**" to "**CC**" (Figure 15), indicating that the calibration is complete.

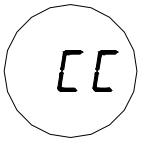

Figure 15: Calibration Complete Mode

Remove the gas and wait for the unit to return to normal operation. The display will indicate a few percent full-scale and then drop to "**0**".

The unit is now calibrated and the new SPAN value has been stored in the non-volatile memory (EEPROM).

4.6.2 Aborting Calibration

If calibration is to be aborted, and gas has not been applied, wait ninety seconds and reapply the magnet. The unit will return to normal operation with the previous calibration values unchanged.

NOTE: Once gas has been applied, it is not possible to abort a calibration.

If the Model S4000T is placed in the Calibration Mode, and no gas is applied for twelve minutes, the unit will revert to a Fault (F2) condition. Re-applying the magnet over the GM Logo will return the unit to operational mode with the previous calibration values unchanged.

4.6.3 Remaining Sensor Life

The Model S4000T Intelligent Sensor provides an estimate of remaining sensor life, in percent remaining, to provide the user with an early warning of the need for sensor replacement. The remaining sensor life is updated each time the unit is calibrated. The current remaining sensor life estimate is displayed during the zeroing portion of a calibration sequence. It can also be read via the MODBUS interface (Section 8.0).

NOTE: The remaining sensor life provides an estimate of the amount of life remaining for the sensor. This estimate can be affected by many factors, including environmental conditions, poisons, etc. It should be used only as an estimate for preventive maintenance and logistic purposes.

4.6.4 Initializing the Remaining Sensor Life

The remaining sensor life estimate must be initialized each time a new Hydrogen Sulfide Sensor is installed. The initialization should be done during the first calibration of a newly installed sensor. After the sensor has been on power for a minimum of one hour, enter calibration mode as described in Section 4.6. While the display is flashing the remaining sensor life estimate during zeroing, apply the magnet to the GM Logo on the cover. The flashing number will change to "**100**", indicating the sensor has 100% of remaining sensor life. Complete the calibration per Section 4.6.1.

4.7 Calibration Equipment

4.7.1 Breaker Bottles and Ampoules

General Monitors offers ampoules with breaker bottles as a method of reliably introducing calibration gas to the Model S4000T. The ampoule is placed inside the breaker bottle into the breaker slot, and the breaker bottle is placed over the sensor. The ampoule should contain 50% FS of H_2S of the sensor range. Follow the calibration procedure in Section 4.6. When the display indicates "**AC**", break the ampoule by turning the thumbscrew on the side of the breaker bottle clockwise. The display will change to "**CP**" indicating that the sensor is seeing the gas. When the display reads "**CC**", the calibration is complete. Remove the breaker bottle and allow the sensor to see clean air. It will return to normal operation once the gas at the sensor is below 5% of full-scale. See Section 9.5 for available equipment.

4.7.2 H_2S Portable Purge Calibrator

An alternate method for introducing calibration or test gas to the Model S4000T is available. The H_2S Portable Purge Calibrator is a compact, practical, accurate and safe system for field calibration of H_2S Sensors. The bottle is filled with a hydrogen sulfide (H_2S) in air mixture and is available in 7 concentrations. The temperature limitation for operation and storage is 0°F to +130°F (-18°C to +54°C).

NOTE: Do not store the cylinder with the regulator fully engaged in the cylinder valve.

Use the calibration procedure listed below for H_2S Portable Purge calibrations:

Make sure the Portable Purge Calibrator contains a gas concentration equivalent to 50% of full-scale for the unit that is going to be calibrated.

1. Ensure that the sensor is seeing clean air. If it is suspected that hydrogen sulfide gas is present, it will be necessary to purge the sensor environment with clean air.
2. Place the gas cup over the sensor and initiate the calibration sequence, by placing the magnet over the GM Logo on the cover of the unit.
3. When the letters "**AC**" appear in the display window remove the magnet and apply the calibration gas (50% of full-scale) by opening the valve on the cylinder.
4. When the sensor begins to see the gas, the display will change from "**AC**" to "**CP**" to indicate "Calibration in Progress".
5. When the calibration sequence is complete, the display will change from "**CP**" to "**CC**" to indicate "Calibration Complete".
6. Remove the gas by closing the valve on the cylinder, and remove the cup allowing the sensor to see clean air. The display will change from "**CC**" to indicate a few parts per million (ppm) and then drop to "**0**".

The unit is now calibrated and the new values have been stored in the EEPROM (non-volatile memory). See Section 9.5 for available equipment.

5.0 Maintenance

5.1 General Maintenance

WARNING: Disconnect or inhibit external devices such as Trip Amplifiers, PLC's, or DCS systems before performing any maintenance.

European Union (EU) Approved Applications: The following grease compound is recommended for use: PBC Polybutylcuprysil, (or equivalent), which has BASEEFA Health & Safety Executive component approval No. 1051U for use as a jointing compound on flameproof electrical enclosures. This is available from General Monitors. The neoprene rubber gasket should also be lubricated with Type P80 lubricant available from General Monitors (P/N 610-010).

5.2 Storage

The Model S4000T H_2S Gas Detector should be stored in a clean, dry area and within the temperature and humidity ranges quoted in the Appendix under Environmental Specifications.

Insert red dust caps into any vacant cable entry holes.

6.0 Troubleshooting

CAUTION: Component level repair must be undertaken either by General Monitors' personnel, or by competent authorized service engineers. SMT PCB repair shall only be performed at a General Monitors' facility. Failure to comply with this requirement will invalidate the warranty.

Be sure to inhibit or disconnect external alarm wiring before making any check, which might send the unit into alarm, if an alarm condition will cause a problem.

6.1 Fault Codes & Their Remedies

The Model S4000T has self-diagnostics incorporated into the microprocessor's program. If a fault is detected, the output signal will drop to 0mA, the Fault relay will de-energize and a fault code will be displayed. The output signal will inform a remote display module that the Model S4000T is in the Fault Mode. The display will indicate a fault code that can be viewed at the sensor site.

There are nine fault conditions that are monitored by the microprocessor as follows:

6.1.1 F2 - Failed to Complete the Calibration

This fault will occur if the unit is placed in the calibration mode and no gas has been applied within twelve minutes, or if gas has been left on for more than 12 minutes.

ACTION – Remove gas, if present. Apply magnet to GM Logo on the cover to clear fault. Re-calibrate, if necessary.

6.1.2 F3 - EPROM Checksum Error

This fault indicates that the contents of the Model S4000T's program memory have changed. This usually occurs when powering the unit up after a lightning strike or large voltage transient on the power or signal lines to the unit.

ACTION - The unit must be returned to the factory or authorized service center for repair.

6.1.3 F4 - Sensor Heater Open Error

This fault indicates that one of the sensor circuit leads is open-circuited.

ACTION - Check the integrity of all sensor connections, and ensure that the cable from the Model S4000T to the remote sensor is not damaged. If this does not correct the problem, replace the sensor and recalibrate.

6.1.4 F5 - Sensor Heater Shorted Error

This fault indicates that one of the sensor circuit leads is short-circuited.

ACTION - Check the integrity of all sensor connections, and ensure that the cable from the Model S4000T to the remote sensor is not damaged. If this does not correct the problem, replace the sensor and recalibrate.

6.1.5 F6 - Low Supply Voltage

This fault occurs if the supply voltage at the S4000T drops below +18.5VDC.

ACTION - Ensure that the supply voltage is at least +20VDC at the Model S4000T.

NOTE: With long supply leads, a considerable voltage drop may occur, due to the electrical resistance of the leads. The maximum cable resistance, which the Model S4000T can tolerate, is dependent on the supply voltage. A maximum of 20 ohms per conductor (40 ohms loop), at +24VDC minimum, or a maximum of 10 ohms per conductor (20 ohms loop), at +20VDC minimum.

6.1.6 F7 - EEPROM Verification Failure

This fault occurs when an attempt to verify the setup/calibration parameters just written to the EEPROM memory fails.

ACTION - The unit must be returned to the factory or authorized service center for repair.

6.1.7 F8 - Failure to Complete Setup

This fault occurs if the unit is left in setup mode for more than 6 minutes.

ACTION - Exit setup mode. Enter setup mode again if it is necessary, to change any user selectable options.

6.1.8 F9 - Gas Check Period Exceeded

If the Model S4000T is left in the gas check mode for more than twelve minutes with Test Gas applied, this fault will occur.

ACTION - Place the magnet over the GM Logo on the cover to return the unit to normal operation.

NOTE: Anytime a sensor is replaced, the unit should be disconnected from all alarms, as the unit may go upscale upon power-up.

6.1.9 F10 – Switch Error

This fault occurs if either the remote test, remote calibrate, or magnetic switch are closed for more than two minutes.

ACTION – Check the wiring on the Remote Reset and Remote Calibrate switches. Once the short circuit is cleared, the unit will return to normal operation. If the magnetic switch is shorted, the unit must be returned to the factory or to an authorized service center for service.

7.0 Customer Support

7.1 General Monitors' Offices

Area	Phone/Fax/Email
UNITED STATES	
	Toll Free: +1-800-446-4872
Corporate Office:	Phone: +1-949-581-4464
26776 Simpatica Circle	Fax: +1-949-581-1151
Lake Forest, CA 92630	Email: info@generalmonitors.com
9776 Whithorn Drive	Phone: +1-281-855-6000
Houston, TX 77095	Fax: +1-281-855-3290
	Email: gmhou@generalmonitors.com
UNITED KINGDOM	
Heather Close	Phone: +44-1625-619-583
Lyme Green Business Park	Fax: +44-1625-619-098
Macclesfield, Cheshire,	Email: info@generalmonitors.co.uk
United Kingdom, SK11 0LR	
IRELAND	
Ballybrit Business Park	Phone: +353-91-751175
Galway, Republic of Ireland	Fax: +353-91-751317
	Email: info@gmil.ie
SINGAPORE	
No. 2 Kallang Pudding Rd.	Phone: +65-6-748-3488
#09-16 Mactech Building	Fax: +65-6-748-1911
Singapore 349307	Email: genmon@gmpacifica.com.sg
MIDDLE EAST	
LOB12, #G20	Phone: +971-4-8815751
P.O. Box 61209	Fax: +971-4-8817927
Jebel Ali, Dubai	Email: gmme@emirates.net.ae
United Arab Emirates	

Table 8: GM Locations

8.0 MODBUS Interface

8.1 Baud Rate

The Baud Rate is selectable via the MODBUS Communications Interface. The selectable baud rates are 19200, 9600, 4800, or 2400 bits per second.

8.2 Data Format

The Data Format is selectable via the MODBUS Communications Interface. The selectable data formats are as follows:

Data Bits	Parity	Stop Bit	Format
8	None	1	8-N-1
8	Even	1	8-E-1
8	Odd	1	8-O-1
8	None	2	8-N-2

Table 9: Data Format

8.3 MODBUS Read Status Protocol (Query/Response)

8.3.1 MODBUS Read Query Message

Byte	MODBUS	Range	Referenced to S4000T
1st	Slave Address	1-247* (Decimal)	S4000T ID (Address)
2nd	Function Code	03	Read Holding Registers
3rd	Starting Address Hi**	00	Not Used by S4000T
4th	Starting Address Lo**	00-FF (Hex)	S4000T Commands
5th	No. Of Registers Hi	00	Not Used by S4000T
6th	No. Of Registers Lo	01	No. Of 16 Bit Registers
7th	CRC Lo	00-FF (Hex)	CRC Lo Byte
8th	CRC Hi	00-FF (Hex)	CRC Hi Byte

***NOTE:** Address 0 is reserved for broadcast mode and will not be supported at this time.

**** NOTE:** Start Address can be a maximum of 9999 Address Locations (0000-270E).

8.3.2 MODBUS Read Response Message

Byte	MODBUS	Range	Referenced to S4000T
1st	Slave Address	1-247* (Decimal)	S4000T ID (Address)
2nd	Function Code	03	Read Holding Registers
3rd	Byte Count	02	No. Of Data Bytes
4th	Data Hi	00-FF (Hex)	S4000T Hi Byte Status Data
5th	Data Lo	00-FF (Hex)	S4000T Lo Byte Status Data
6th	CRC Lo	00-FF (Hex)	CRC Lo Byte
7th	CRC Hi	00-FF (Hex)	CRC Hi Byte

8.4 MODBUS Write Command Protocol (Query/Response)

8.4.1 MODBUS Write Query Message

Byte	MODBUS	Range	Referenced to S4000T
1st	Slave Address	1-247* (Decimal)	S4000T ID (Address)
2nd	Function Code	06	Preset Single Register
3rd	Register Address Hi	00	Not Used by S4000T
4th	Register Address Lo	00-FF (Hex)	S4000T Commands
5th	Preset Data Hi	00-FF (Hex)	S4000T Hi Byte Command Data
6th	Preset Data Lo	00-FF (Hex)	S4000T Lo Byte Command Data
7th	CRC Lo	00-FF (Hex)	CRC Lo Byte
8th	CRC Hi	00-FF (Hex)	CRC Hi Byte

***NOTE:** Address 0 is reserved for broadcast mode and will not be supported at this time.

****NOTE:** Start Address can be a maximum of 9999 Address Locations (0000-270E).

8.4.2 MODBUS Write Response Message

Byte	MODBUS	Range	Referenced to S4000T
1st	Slave Address	1-247* (Decimal)	S4000T ID (Address)
2nd	Function Code	06	Preset Single Register
3rd	Register Address Hi	00	Not Used by S4000T
4th	Register Address Lo	00-FF (Hex)	S4000T Commands
5th	Preset Data Hi	00-FF (Hex)	S4000T Hi Byte Command Data
6th	Preset Data Lo	00-FF (Hex)	S4000T Lo Byte Command Data
7th	CRC Lo	00-FF (Hex)	CRC Lo Byte
8th	CRC Hi	00-FF (Hex)	CRC Hi Byte

8.5 Function Codes Supported

Function Code 03 (Read Holding Registers) will be used to read status from the slave unit.

Function Code 06 (Preset Single Register) will be used to write a command to the slave unit.

8.6 Exception Responses and Exception Codes

8.6.1 Exception Response

In a normal communications query and response, the master device sends a query to the S4000T and the S4000T receives the query without a communications error and handles the query normally within the master device's allowable timeout. The S4000T then returns a normal response to the master. An abnormal communications produces one of four possible events:

1. If the S4000T does not receive the query due to a communications error, then no response is returned from the S4000T and the master device will eventually process a timeout condition for the query.

2. If the S4000T receives the query, but detects a communication error (CRC, etc.), then no response is returned from the S4000T and the master device will eventually process a timeout condition for the query.

3. If the S4000T receives the query without a communications error, but cannot process

the response to the master within the master's timeout setting, then no response is returned from the S4000T. The master device will eventually process a timeout condition for the query. **In order to prevent this condition from occurring, the maximum response time for the S4000T is 200 milliseconds. Therefore, the master's timeout setting should be set to 200 milliseconds or greater.**

4. If the S4000T receives the query without a communications error, but cannot process it due to reading or writing to a non-existent S4000T command register, then the S4000T will return an exception response message informing the master of the error.

The exception response message (ref. No. 4 above) has two fields that differentiate it from a normal response:

Byte	MODBUS	Range	Referenced to S4000T
1st	Slave Address	1-247* (Decimal)	S4000T ID (Address)
2nd	Function Code	83 or 86 (Hex)	MSB is set with Function Code
3rd	Exception Code	01 - 06 (Hex)	Appropriate Exception Code (See Below)
4th	CRC Lo	00-FF (Hex)	CRC Lo Byte
5th	CRC Hi	00-FF (Hex)	CRC Hi Byte

8.6.2 Exception Code

Exception Code Field: In a normal response, the S4000T returns data and status in the data field, which was requested in the query from the master. In an exception response, the S4000T returns an exception code in the data field, which describes the S4000T condition that caused the exception. Below is a list of exception codes that are supported by the S4000T:

Code	Name	Description
01	Illegal Function	The function code received in the query is not an allowable action for the S4000T
02	Illegal Data Address	The data address received in the query is not an allowable address for the S4000T.
03	Illegal Data Value	A value contained in the query data field is not an allowable value for the S4000T.
04	Slave Device Failure	An unrecoverable error occurred while the S4000T was attempting to perform the requested action.
05	Acknowledge	The S4000T has accepted the request and is processing it, but a long duration of time will be required to do so. This response is returned to prevent a timeout error from occurring in the master.
06	Device Busy	The S4000T is engaged in processing a long-duration program command. The master should retransmit the message later when the slave is free.

Table 10: Exception Codes

8.7 S4000T Command Register Locations

Parameter	Function	Type	Scale	Access	Register Address	Master I/O Address
Analog	0-20mA Current Output	Value	16-Bit	R	0000	40001
Mode	Indicates and Controls Mode	Bit		R/W	0001	40002
Status/Error	Indicates Errors		Bit	R	0002	40003
Not Used	N/A					40004
Unit Type	Identifies the S4000T in Decimal	Value	16-Bit	R	0004	40005
Software Rev	Indicates the Software Revision	ASCII	2-Char	R	0005	40006
Status Block	Returns Analog, Mode, Status, Error, and Sensor Life	Multi	6-bytes	R	0006	40007
Not Used	N/A					40008-40013
Alarm Settings	Read or change settings for the high alarm	Bit	(0-15)	R/W	000D	40014
Warn Settings	Read or change settings for the low alarm	Bit	(0-15)	R/W	000E	40015
Com1 Addr.	Read or change settings for the Com1 Address	Value	8-Bit	R/W	000F	40016
Com1 Baud	Read or change settings for the Com1 Baud Rate	Bit	(0-7)	R/W	0010	40017
Com1 Data Format	Read or change settings for the Com1 Data Format	Bit	(0-7)	R/W	0011	40018
Com2 Addr.	Read or change settings for the Com2 Address	Value	8-Bit	R/W	0012	40019
Com2 Baud	Read or change settings for the Com2 Baud Rate	Bit	(0-7)	R/W	0013	40020
Com2 Data Format	Read or change settings for the Com2 Data Format	Bit	(0-7)	R/W	0014	40021
Not Used	N/A					40022
Reset Alarms	Reset any latched alarms	Bit	(0)	W	0016	40023
Sensor Life	Read the Remaining Sensor Life	Bit	(0)	R	0017	40024
Sensor Scale	Change the Scale for the H_2S sensors on the S4000T	Value	8-Bit	R/W	0018	40025
HazardWatch (Co)	Indicates Calibration Success	Value	8-Bit	R/W	0019	40026
Not Used	N/A					40027-40032
Total Receive Errors	Total # of Receive Errors	Value	8-Bit	R	0020	40033
Bus Activity Rate %	Bus Activity Rate in % of This Addressed Node vs. Other Addressed Nodes	Decimal		R	0021	40034
Function Code Errors	Total # of Function Code Errors	Value	8-Bit	R	0022	40035
Starting Addr. Errors	Total # of Starting Address Errors	Value	8-Bit	R	0023	40036

Table 11: Command Register Locations

Parameter	Function	Type	Scale	Access	Register Address	Master I/O Address
No. of Register Errors	Total # of Register Errors	Value	8-Bit	R	0024	40037
RXD CRC Hi Errors	Total # of RXD CRC Hi Errors	Value	8-Bit	R	0025	40038
RXD CRC Low Errors	Total # of RXD CRC Low Errors	Value	8-Bit	R	0026	40039
Not Used	N/A				0027 - 002C	40040-40045
Clear Comm Errors	Clear All Comm Errors	Bit	(0)	W	002D	40046

Table 12: Command Register Locations, Cont.

8.8 S4000T Command Register Details

8.8.1 Analog

A read returns a value, which is proportional to the 0-20mA output current. The current is based on a 16-bit value. The scaling is 0 - 65535 decimal which corresponds to 0 - 21.7mA.

8.8.2 Mode

A read returns the present mode of the S4000T. A write command changes the mode to the requested mode.

Exception: Returns an Exception Code 01 (illegal function) if an illegal write is requested.

A calibrate command returns an Exception Code 01 (Acknowledge 05). The operation will take a long time to complete.

Function	Bit Position	Access
Calibration Complete	7 MSB	Read
Spanning	6	Read
Zero Complete, Waiting for Gas	5	Read
Zeroing	4	Read
Calibration Mode	3	Read/Write
Calibration Check Mode	2	Read/Write
Run Mode	1	Read
Startup Mode	0 LSB	Read

8.8.3 Status/Error

A read returns the Alarm state and Errors that are occurring at the present time, which are indicated, by bit position.

Function	Bit Position	Access
Alarm	15 MSB	Read
Warn	14	Read
Fault	13	Read
Not Used	12	Read
Not Used	11	Read
Not Used	10	Read
Not Used	9	Read
Switch Error	8	Read
Setup Error	7	Read
Calibration Check Timeout	6	Read
EEPROM Error	5	Read
EPROM Error	4	Read
Sensor Error	3	Read
Fail to Calibrate	2	Read
Low Supply Voltage	1	Read

8.8.4 Unit Type

A read returns the Decimal Value 4000. This identifies the S4000C.

A read returns the Decimal Value 4001. This identifies the S4000T.

8.8.5 Software Revision

A read returns the software revision of the S4000T in 2 ASCII characters.

8.8.6 Status Block

A read returns a 6-byte message containing the analog (2 bytes), Mode (1 byte), Status/Error (2 bytes), and Sensor Life (1 byte) in that order. For the format of each byte, refer to the appropriate individual commands.

8.8.7 Alarm Settings

A read returns the present Alarm settings of the S4000T. A write command changes the settings to the requested values. The set points are programmable in 5% FS steps (1% FS steps for 20ppm range).

A 1 in the 9th bit position means the output is latching, a 0 means it is Non-Latching. A 1 in the 8th bit position means the output is normally energized a 0 means it is normally De-Energized. The Alarm set point cannot be set below the Warn set point. **Factory default is: 60% FS, latching, de-energized.**

Exception: Returns an Exception Code 01 (illegal function) if an illegal write is requested.

Byte	Function	Bit Position	Access
High	Not Used	15 MSB	Read
	Not Used	14	Read
	Not Used	13	Read
	Not Used	12	Read
	Not Used	11	Read
	Not Used	10	Read
	Latching/Non-Latching	9	R/W
	Energized/De-Energized	8	R/W
Low	Set point	(7-0)	R/W

8.8.8 Warn Settings

A read returns the present Warn settings of the S4000T. A write command changes the settings to the requested values. The set points are programmable in 5% FS steps (1% FS steps for 20ppm range).

A 1 in the 9th bit position means the output is latching, a 0 means it is Non-Latching. A 1 in the 8th bit position means the output is normally energized a 0 means it is normally De-Energized. The Warn set point cannot be set above the Alarm set point. **Factory default is: 30% FS, non-latching, de-energized. The maximum allowable set point is 50ppm.**

Exception: Returns an Exception Code 01 (illegal function) if an illegal write is requested.

Byte	Function	Bit Position	Access
High	Not Used	15 MSB	Read
	Not Used	14	Read
	Not Used	13	Read
	Not Used	12	Read
	Not Used	11	Read
	Not Used	10	Read
	Latching/Non-Latching	9	R/W
	Energized/De-Energized	8	R/W
Low	Set point	(7-0)	R/W

8.8.9 Com1 Address

A read command returns the current address for Com1. A write command changes the address to the requested value. Valid addresses are 1-247 decimal. **Factory default is 1**.

Exception: If the address is not in range an Illegal data value (03) is returned.

8.8.10 Com1 Baud Rate

A read command returns the current baud rate for Com1. A write command changes the baud rate to the requested values. Valid settings are shown in the table below. **Factory default is 19,200.**

Baud Rate	Value	Access
2400	24	Read/Write
4800	48	Read/Write
9600	96	Read/Write
19,200	192	Read/Write

Table 13: Com1 Baud Rate

Exception: If the baud rate is not in range, an illegal data value (03) is returned.

8.8.11 Com1 Data Format

A read command returns the current data format for Com1. Write command changes the data format to the requested values. Valid settings are shown in the table below. **Default format is 8-N-1.**

Data	Parity	Stop	Format	Data(Bits 9-8)	Access
8	None	1	8-N-1	0	Read/Write
8	Even	1	8-E-1	1	Read/Write
8	Odd	1	8-O-1	2	Read/Write
8	None	2	8-N-2	3	Read/Write

Table 14: Com1 Data Format

Exception: If the data format is not in range, an illegal data value (03) is returned.

8.8.12 Com2 Address

A read command returns the current address for Com2. A write command changes the address to the requested values. Valid addresses are 1-247 decimal. **Factory default is 2**.

Exception: If the address is not in range an Illegal data value (03) is returned.

8.8.13 Com2 Baud Rate

A read command returns the current baud rate for Com2. A write command changes the baud rate to the requested values. Valid settings are shown in the table below. **Factory default is 19,200.**

Baud Rate	Value	Access
2400	24	Read/Write
4800	48	Read/Write
9600	96	Read/Write
19,200	192	Read/Write

Table 15: Com2 Baud Rate

Exception: If the baud rate is not in range an illegal data value (03) is returned.

8.8.14 Com2 Data Format

A read command returns the current data format for Com2. Write command changes the data format to the requested values. Valid settings are shown in the table below. **Factory default is 8-N-1.**

Data	Parity	Stop	Format	Data(Bits 9-8)	Access
8	None	1	8-N-1	0	Read/Write
8	Even	1	8-E-1	1	Read/Write
8	Odd	1	8-O-1	2	Read/Write
8	None	2	8-N-2	3	Read/Write

Table 16: Com2 Data Format

Exception: If the data format is not in range an illegal data value (03) is returned.

8.8.15 Reset Alarms

A write to this register with a data value of 1 will reset any latched alarms provided the current gas level is below the alarm set point.

8.8.16 Sensor Life

A read returns the current estimate of remaining sensor life in percentage.

8.8.17 Sensor Scale

A read returns the current H_2S sensor scale selected: 0-20ppm, 0-50ppm, 0-100ppm. A write changes the scale to the desired scale. If the scale is changed, a calibration fault is generated, forcing the operator to calibrate the unit.

H2S Sensor Scale	Value (decimal)
0-20 ppm	20
0-50 ppm	50
0 –100 ppm	100

Table 17: Sensor Scale

8.8.18 HazardWatch (Co – Calibration Output)

A read to this register will return the status of the HazardWatch Option.

0x01 enables this option, 0x00 disables this option, similar to the write.

NOTE: Only Com1 can support read/write to this register.

8.8.19 Total Receive Errors

A read indicates the total MODBUS Comm Receive Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

The total errors are an accumulation of the individual communication errors listed below:

8.8.20 Bus Activity Rate %

A read indicates the Bus Activity Rate in percent of this Slave's addressed node versus other addressed nodes. Range of this value is in hex (0-64) which translates to decimal (0-100%).

8.8.21 Function Code Errors

A read indicates the number of Function Code Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

8.8.22 Starting Address Errors

The counter is incremented for each address that does not equal the device address.

A read indicates the number of Starting Address Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

8.8.23 Number of Register Errors

A read indicates the Number of Register Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

8.8.24 RXD CRC Hi Errors

A read indicates the number of RXD CRC Hi Byte Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

8.8.25 RXD CRC Low Errors

A read indicates the number of RXD CRC Low Byte Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

8.8.26 Clear Comm Errors

A Read or Write resets all the MODBUS Comm Error counters to zero.

9.0 Appendix

9.1 Warranty

General Monitors warrants the Model S4000T to be free from defects in workmanship or material under normal use and service within two years from the date of shipment.

General Monitors will repair or replace without charge any such equipment found to be defective during the warranty period. Full determination of the nature of, and responsibility for, defective or damaged equipment will be made by General Monitors' personnel.

Defective or damaged equipment must be shipped to the General Monitors' plant or representative from which the original shipment was made. In all cases this warranty is limited to the cost of the equipment supplied by General Monitors. The customer will assume all liability for the misuse of this equipment by its employees or other personnel.

All warranties are contingent upon proper use in the application for which the product was intended and does not cover products which have been modified or repaired without General Monitors' approval, or which have been subjected to neglect, accident, improper installation or application, or on which the original identification marks have been removed or altered.

Except for the express warranty stated above, General Monitors disclaims all warranties with regard to the products sold, including all implied warranties of merchantability and fitness and the express warranties stated herein are in lieu of all obligations or liabilities on the part of General Monitors for damages including, but not limited to, consequential damages arising out of, or in connection with, the performance of the product.

9.2 Principle of Operation

General Monitors uses a proprietary Metal Oxide Semiconductor (MOS) film on the sensor for detecting Hydrogen Sulfide (H_2S) gas. The MOS film is deposited onto a substrate between two electrodes. With no gas present, the measured resistance between these two electrodes is very high (in the mega-ohms). As H_2S adsorbs onto the film, the resistance between the two electrodes decreases (to kilo-ohms). This decrease in resistance is logarithmically proportional to the concentration of H_2S that is present.

The change in resistance is converted to a change in voltage, and amplified by the input circuit. This amplified signal is fed to an Analog to Digital (A/D) Converter, converted to a digital signal and sent to the microprocessor to be processed. The process of H_2S adsorbing onto the MOS film is most effective at an elevated temperature. On the outer edge of the substrate is a heater ring. The temperature of this heater ring is measured with a thermistor, and kept constant by a circuit located inside the body of the sensor.

As H_2S adsorbs onto the film, electrons move more freely from one electrode to the other. This is represented as a decrease in resistance. The process of H_2S adsorbing onto the MOS film is completely reversible. As the concentration of H_2S decreases (H_2S desorbs), the resistance between the electrodes will increase.

9.3 Specifications

9.3.1 System Specifications

Sensor Type:	Continuous diffusion, adsorption type Metal Oxide Semiconductor (MOS)
Sensor Life:	3 to 5 years typical
Repeatability:	±2 ppm or 10% of the applied gas, whichever is greater
Response Time:	T50<1 minute (screen) T50<2 minutes (sintered) with full scale gas applied
Measuring Ranges:	0-20 ppm, 0-50 ppm, 0-100 ppm
Modes:	Calibration, gas check, setup
Electrical Classification:	**CSA/FM:** Class I, Division 1, Groups B, C, D and Class I, Zone 1, Ex d IIB+H_2, T6. **ATEX:** EEx d IIB T6 (Tamb=-40°C to +40°C)
Warranty:	Two years

9.3.2 Mechanical Specifications

Length:	6.4 inches (161mm)
Height:	3.4 inches (86mm)
Width:	4.1 inches (104mm)
Weight:	5.5 lbs. (2.5 kg)
Mounting Holes:	5.0 inches (127mm) (center to center)

9.3.3 Electrical Specifications

Input Power:	24 VDC nominal, 20 to 36 VDC, 350mA max.
Power Consumption	Start-up 270mA, Normal Operation 120mA
Relay Ratings:	8A @ 250 VAC/8A @ 30 VDC resistive max. (3x) SPDT - Warning, Alarm & Fault
Analog Signal:	0-20mA (650 ohms max. load) Malfunction 0mA Gas Check 1.5mA Setup mode 1.5mA Calibration 1.5mA Zero reading 4mA±0.2mA 0-100% scale 4-20mA Over-range 20-22mA
Status Indicators:	Three-digit digital display with gas concentration, Warn and Alarm LED's, calibration prompts, fault codes, and setup options
RS-485 Output:	Dual Redundant MODBUS RTU, suitable for linking up to 128 units or up to 247 units with repeaters
Baud Rate:	2400, 4800, 9600, or 19200 BPS
Faults Monitored:	Open AO, calibration error, sensor heater error, low DC supply, EEPROM, EPROM, setup error, gas check time exceeded, switch error.
RFI/EMI Protection:	Complies with EN50081-2, EN50082-2

Cable Requirements: 3-wire shielded cable. Max. distance between S4000T and power source @ 24 VDC nominal

AWG	FEET	METERS
14	3430	1040
16	1550	410
18	1050	320
20	650	200

Table 18: 24VDC Cable Lengths

Max. distance for analog output (650 ohms max):

AWG	FEET	METERS
14	9000	2740
16	5200	1585
18	3800	1160
20	2400	730

Table 19: Analog Output Cable Lengths

Max. distance between the transmitter and sensor with one way resistance of 10 ohms (20-Ohm loop):

AWG	FEET	METERS
14	3700	1125
16	2400	730
18	1500	460
20	1000	300

Table 20: Sensor Cable Lengths

European Union (EU) Approved Applications: PSU noise and ripple voltage 1.0Vpp max. The customer supplied PSU must comply with IEC 1010-1, limiting current to 8A under Fault conditions, in order to comply with CE Marking requirements.

9.3.4 Environmental Specifications

Operating Temperature Range

CSA/FM:

Electronics	-40°F to 167°F (-40°C to 75°C)
Standard Sensor	-40°F to 167°F (-40°C to 75°C)
High Temp Sensor	-40°F to 195°F (-40°C to 90°C)

ATEX:

Electronics (T6)	-40°F to 104°F (-40°C to + 40°C)

Storage Temperature Range: -58°F to 185°F (-50°C to +85°C)

Operating Humidity Range: 5% to 100% RH, non-condensing

9.4 Approvals

CSA, FM, ATEX, CE Marking, GOST permission to use

Compiles with ISA-92.0.01, Part 1-1998 performance requirements

9.5 Spare Parts and Accessories

To order spare parts and/or accessories, please contact the nearest General Monitors' Representative or, General Monitors directly, and give the following information:

- Part Number of Spare Part or Accessory
- Description of Spare Part or Accessory
- Quantity of Spare Part or Accessory

9.5.1 Sensors

50445-1	0 to 100ppm, Aluminum Body, Wire Screen Arrestor
50445-5	0 to 50ppm, Aluminum Body, Wire Screen Arrestor
50445-9	0 to 20ppm, Aluminum Body, Wire Screen Arrestor
50448-1HT	0 to 100ppm, Stainless Steel Body, Wire Screen Arrestor, High Temp
50448-5HT	0 to 50ppm, Stainless Steel Body, Wire Screen Arrestor, High Temp
50448-9HT	0 to 20ppm, Stainless Steel Body, Wire Screen Arrestor, High Temp
51457-1L	0 to 100ppm, Stainless Steel Body, Sintered Steel Arrestor
51457-5L	0 to 50ppm, Stainless Steel, Sintered Steel Arrestor
51457-9L	0 to 20ppm, Stainless Steel, Sintered Steel Arrestor
50460-1	Sensor Simulator

9.5.2 Sensor Housing

10252-1	Universal Housing

9.5.3 Sensor Accessories

10041-1	Duct Mounting Plate
10044-1	Dust Guard Kit - 1 Guard, 12 Replaceable Screens
10042-1	Replaceable Screens, Box of 12
10395-1	Splash Guard Assembly
10110-1	Dust Guard Assembly
1800822	Dust Guard, Sintered SST
10066	Sensor Flow Chamber

9.5.4 Calibration Equipment

50000	Breaker Bottle, Single
50004-3	Individual Ampoules, 10 ppm (12 minimum)
50004-21	Individual Ampoules, 25 ppm (12 minimum)
50004-13	Individual Ampoules, 50 ppm (12 minimum)
50008-9	12 Ampoules at 50ppm (0-100ppm scale)
50008-16	12 Ampoules at 25ppm (0-50ppm scale)
50008-10	12 Ampoules at 10ppm (0-20ppm scale)
50009-9	12 Ampoules at 50ppm, includes breaker bottle (0-100ppm scale)
50009-16	12 Ampoules at 25ppm, includes breaker bottle (0-50ppm scale)
50009-10	12 Ampoules at 10ppm, includes breaker bottle (0-20ppm scale)
1400250-1	10ppm H_2S Portable Purge Calibration Assembly
1400250-3	25ppm H_2S Portable Purge Calibration Assembly
1400250-5	50ppm H_2S Portable Purge Calibration Assembly
1400255-1	10ppm H_2S Replacement Cylinder
1400255-3	25ppm H_2S Replacement Cylinder
1400255-5	50ppm H_2S Replacement Cylinder

Case for Portable Purge Assembly

922-016 Replacement Regulator (0.2 L/min)

Replacement Hose

960-345 Hose Clamp, 5/16”

960-346 Hose Clamp, ¼”

1400152-1 Calibration Cup

9.5.5 Intelligent Sensor (S4000T) Replacement Parts

31161-1 Control Board Electronics

31151-1 Output Board Electronics

31156-1 Display Board Electronics

31170-2 Enclosure Cover Assembly with Window

31195-2 Enclosure Base Assembly

30051-1 Explosion-Proof SPST Switch

30060-1 Calibration Magnet

Cover Assy., O-Ring

9.5.6 Recommended Spare Parts for One (1) Year

30060-1 Extra Calibration Magnet (Qty. 1)

9.6 FMRC Approval

Factory Mutual Research Corporation

1151 Boston-Providence Turnpike

Norwood, Massachusetts 02062

Approval of the transmitter does not include or imply approval of apparatus, to which the transmitter may be connected and which processes the electronic signal for the eventual end use. In order to maintain FMRC approved system, the control instrument, to which the subject instrument is connected, must also be FMRC approved.

The following sensors have been FMRC approved for use with the Model S4000T:

- 50445-1 Aluminum Body H2S Gas Specific MOS Sensor, 0 to 100 ppm
- 50445-5 Aluminum Body H2S Gas Specific MOS Sensor, 0 to 50 ppm
- 50445-9 Aluminum Body H2S Gas Specific MOS Sensor, 0 to 20 ppm
- 50448-1HT Stainless Steel Body H2S Gas Specific MOS Sensor, 0 to 100 ppm
- 50448-5HT Stainless Steel Body H2S Gas Specific MOS Sensor, 0 to 50 ppm
- 50448-9HT Stainless Steel Body H2S Gas Specific MOS Sensor, 0 to 20 ppm

The following apparatus have been FMRC approved (although they have not been verified as part of a Model S4000T system):

- Model DT210 Eight-Channel Readout/Relay Display Module with Power Supply and Relay Module
- Model DT230 Dual-Channel Readout/Relay Display Module

ADDENDUM
Product Disposal Considerations

This product may contain hazardous and/or toxic substances.

EU Member states shall dispose according to WEEE regulations. For further General Monitors' product WEEE disposal information please visit:
www.generalmonitors.com/customer_support/faq_general.html

All other countries or states: please dispose of in accordance with existing federal, state and local environmental control regulations.

Smart Pro UPS System

Intelligent, line-interactive battery backup for network and telecommunications systems

Cisco Compatible

Model #: SMART2200NET

- 2200VA line interactive tower UPS system for 120V network and telecommunications systems
- 3 Serial ports (1 RS-232, 2 contact closure), PowerAlert software and cabling
- Corrects brownouts and overvoltages from 87-140V
- Expandable with multiple BP24V33 external battery packs
- $250,000 Ultimate Lifetime Insurance (USA, Puerto Rico & Canada only)
- Estimated Retail Pricing: $799.00

DESCRIPTION

Tripp Lite's SMART 2200NET intelligent, line interactive large tower UPS system protects servers, networking accessories and telecommunications equipment from blackouts, voltage fluctuations and transient surges. Large internal batteries offer 27 minutes half load runtime and 11 minutes fully loaded. Runtime is expandable with optional BP24V33 external battery packs. 2200VA / 1700 watt power handling capability supports a variety of networking, telecom and other sensitive electronic applications. Includes 6 protected outlets. Supports remote monitoring of UPS and site power conditions via built-in RS-232 enabled monitoring port, plus standard UPS monitoring via 2 built in contact closure ports. Includes PowerAlert UPS monitoring and unattended shutdown software with complete cabling. Built-in audible alarm and front panel LEDs indicate line power, battery power, battery charge level, load level, plus voltage regulation status. Network grade AC surge suppression protects equipment from damage and performance problems resulting from transient surges. Attractive large gray tower housing. Two year warranty with $250,000 connected equipment insurance.

KEY BUYING POINTS

- SMART 2200NET line interactive UPS offers battery derived AC output during power outages, voltage regulation during brownouts and overvoltages, plus network-grade AC surge suppression
- 2200VA / 1700 watt power handling capability supports a variety of networking, telecom and other sensitive electronic devices
- Large internal batteries offer runtimes of 27 minutes at half load (1100VA / 850 watts) and 11 minutes at full load (2200VA / 1700 watts)
- Runtime is further expandable with optional external BP24V33 battery packs (output VA is derated as external battery packs are added, see specifications)
- Automatic Voltage Regulation (AVR) circuits maintain 120V nominal output over an input voltage range of 87-140V
- Includes 6 fully protected NEMA 5-15R outlets with 2 single outlet load banks that can be individually powered off and back on again via software interface
- PowerAlert UPS monitoring and unattended shutdown software enables configurable network broadcast messaging, pager & email notification, event logging and running user defined script commands
- Offers simultaneous monitoring of up to 3 directly connected devices through included DB9 contact closure and RS-232 enabled interfaces, or the monitoring of any number of additional servers over IP with included PowerAlert monitoring software
- In addition to the contact closure monitoring of on battery, low battery and power restored messaging, built-in RS-232 interface supports messaging of UPS and line power status, including AC line voltage, DC battery voltage and remaining battery capacity
- Supports activate self-test and UPS output power control for scheduled or immediate reboot of connected equipment
- Diagnostic LEDs (indicate 17 performance conditions)
- UL (USA), cUL (Canada), NOM (Mexico), FCC Class A (Business) Listed
- $250,000 Ultimate Lifetime Insurance (USA & Canada Only)

TYPICAL APPLICATIONS

- Ideal for the protection of communication equipment including: routers, hubs, switches, IP-PBX, Traditional PBX and Key/Hybrid Telephone Systems. Also ideal for the protection of data processing equipment such as fileservers, workstations and other sensitive devices requiring clean, continuously regulated output power. Extended runtimes are available using additional external battery packs

(BP24V33).

OPTIONS & ACCESSORIES

- External battery pack: BP24V33
- Dataline protectors: DNET1, DTEL2, DCATV
- Circuit Tester: CT120
- Power Distribution: RS-1215, PDU1215
- Extended warranties: 3 Year WEXT3-2200-3000, 5 Year WEXT5-2200-3000

PACKAGE INCLUDES

- SMART 2200NET UPS System
- PowerAlert Software and three 6 foot network cables
- Warranty information
- Instruction manual

COMPLETE SPECIFICATIONS

SYSTEM OVERVIEW

System overview:	Line interactive tower UPS protects internetworking and telecommunications equipment from blackouts, brownouts, overvoltages, surges and line noise. Maintains AC output during blackouts and continuously corrects brownouts and overvoltages from 87 to 140 volts back to normal 120V levels. Supports external battery packs for extended runtime. Includes 3 built-in DB9 serial ports, PowerAlert UPS monitoring software and two customized load management receptacles.
Voltage compatibility:	120 V AC
Frequency compatibility:	60 Hz

OUTPUT

Output volt amp capacity (VA):	2200
Output watt capacity (watts):	1700
Output nominal voltage:	120V AC
Output voltage regulation:	LINE MODE: Sine wave line voltage 120V (-13% / +5%) BATTERY MODE: PWM sine wave output 120V +/-5%
Output frequency regulation:	LINE MODE: Passes line frequency of 60Hz +/-10% BATTERY MODE: Inverter output regulated to 60Hz +/-0.5Hz
Outlet quantity / type:	6 NEMA 5-15R
Customized load management receptacles:	3 serial ports
Overload protection:	Via 20A input breaker

INPUT

Maximum input amps:	15A, 1770 watts
Input connection type:	NEMA 5-15P
Input cord length:	8 ft., 12 gauge
Recommended electrical service:	20A 120V

BATTERY

Full load runtime:	11 minutes (2200VA)
Half load runtime:	27 minutes (1100VA)

Expandable battery runtime:	Supports extended runtime with optional BP24V33 external battery pack (multi-pack compatible). Capacity de-rates to 1600VA / 1280 watts with 1 external BP and 1250VA / 800 watts with 2 external BPs
DC system voltage:	24 V DC
Typical battery lifespan:	3-6 years, depending on usage
Battery recharge rate:	2-4 hours to 90%

VOLTAGE REGULATION

Voltage regulation description:	Line interactive UPS offers 2 boost levels of brownout correction and a single level of overvoltage adjustment to maintain usable, computer grade output without consuming battery power.
Overvoltage correction:	Input voltages between 127 and 140V AC are reduced by 12%
Direct pass through:	Input voltages between 110 and 127V AC are passed through unchanged
Brownout correction:	Input voltages between 95 and 105V AC are boosted by 10%
Severe brownout correction:	Input voltages between 87 and 94V AC are boosted by 22%

LEDS ALARMS & SWITCHES

Front panel LEDs:	Includes 5 front panel LEDs to indicate BATTERY CHARGE LEVEL, AC LINE POWER STATUS, VOLTAGE REGULATION STATUS, UPS LOAD LEVEL and BATTERY LOW / REPLACE information
Alarms:	Audible alarm with 15 second delay sounds to indicate loss of utility power. Alarm can be silenced by pressing front panel alarm cancel button. Once silenced, alarm will re-sound when approximately 2 minutes runtime remain.
Switches:	Includes 2 front panel switches — one on/standby power switch and one dual function "alarm cancel" / "self test" button, plus 1 rear panel system enable switch

SURGE / NOISE SUPPRESSION

AC surge suppression:	480 joules
AC suppression response time:	Instantaneous
EMI / RFI AC noise suppression:	Yes

PHYSICAL

Shipping weight (lbs):	87
Shipping weight (kg):	39.5
Unit weight (lbs):	80
Unit weight (kg):	36.3
Unit Dimensions (HWD/in):	17 x 9 x 12.5
Unit Dimensions (HWD/cm):	41.9 x 22.9 x 31.1
Shipping Dimensions (HWD/in):	22.25 x 12.75 x 16.5
Shipping Dimensions (HWD/cm):	57.2 x 32.4 x 42
Material of construction:	Polycarbonate
Form factors supported:	Tower
Cooling method:	Convection

ENVIRONMENTAL

Operating Temperature:	+32 to +104 degrees Fahrenheit 0 to +40 degrees Celsius
Storage Temperature:	+5 to +122 degrees Fahrenheit -15 to +50 degrees Celsius
Relative Humidity:	0 to 95%, non-condensing
Line mode BTU/hr. (Max.):	148.2

Battery mode BTU/hr. (Max.):	502.6

COMMUNICATIONS

Network monitoring port:	Includes 3 built-in DB9 monitoring ports, 1 enabled with RS-232 data communications and 2 with standard contact closure communications. All interfaces support on battery, low battery and power restored messaging. RS-232 enabled port adds data regarding AC line voltage, DC battery voltage, load percentage, battery charge current, battery capacity, internal UPS temperature and line frequency status messaging. Supports individual reboot of selected items connected to load management receptacles and load shedding to increase battery runtime for the most critical loads.
Software and cabling included:	Includes PowerAlert UPS monitoring software for all common network and standalone operating systems.

LINE / BATTERY TRANSFER

Transfer time from line power to battery mode:	2-4 milliseconds
Low voltage transfer to battery power:	Switches to battery power as line voltage decreases to 87 volts or less
High voltage transfer to battery power:	Switches to battery power as line voltage increases to 140 volts or higher.

CERTIFICATIONS

Certifications:	UL1778 (USA), cUL (Canada), FCC Class A (emissions), NOM (Mexico)

WARRANTY

Optional coverage:	3-5 year warranties, plus next day and on-site warranty coverage available for select opportunities. Contact Tripp Lite for additional information
Product warranty:	2 year product warranty
Connected equipment insurance (USA and Canada Only):	$250,000 connected equipment insurance (USA / Canada only)

SPECIAL FEATURES

Appearance:	Attractive gray tower UPS

BATTERY PACK ACCESSORY (optional)

Battery Pack Accessory (optional):	BP24V33

The policy of Tripp Lite is one of continuous improvement.
Specifications are subject to change without notice.
Therefore, your product may vary slightly from what is currently listed.

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Smart Pro UPS System

Intelligent, line-interactive battery backup for network and telecommunications systems

Cisco Compatible

Model #: SMART3000NET

- 3000VA line interactive tower UPS system for 120V network and telecommunications systems
- 3 Serial ports (1 RS-232, 2 contact closure), PowerAlert software and cabling
- Corrects brownouts and overvoltages from 87-140V
- Expandable with multiple BP24V33 external battery packs
- $250,000 Ultimate Lifetime Insurance (USA, Puerto Rico & Canada only)
- Estimated Retail Pricing: $1,000.00

Enterprise Assistance

E-mail us your critical extended run application requirements for large kVA and extended run UPS Systems and we will research the ideal solution and provide a custom configuration.

Contact a Tripp Lite Product Specialist

DESCRIPTION

Tripp Lite's SMART 3000NET intelligent, line interactive large tower UPS system protects servers, networking accessories and telecommunications equipment from blackouts, voltage fluctuations and transient surges. Large internal batteries offer 23 minutes half load runtime and 7 minutes fully loaded. Runtime is expandable with optional BP24V33 external battery packs. 3000VA / 2400 watt power handling capability supports a variety of networking, telecom and other sensitive electronic applications. Includes 8 protected outlets. Supports remote monitoring of UPS and site power conditions via built-in RS-232 enabled monitoring port, plus standard UPS monitoring via 2 built in contact closure ports. Includes PowerAlert UPS monitoring and unattended shutdown software with complete cabling. Built-in audible alarm and front panel LEDs indicate line power, battery power, battery charge level, load level and voltage regulation status. Network grade AC surge suppression protects equipment from damage and performance problems resulting from transient surges. Attractive large gray tower housing. Two year warranty with $250,000 connected equipment insurance.

KEY BUYING POINTS

- SMART 3000NET line interactive UPS offers battery derived AC output during power outages, voltage regulation during brownouts and overvoltages, plus network-grade AC surge suppression
- 3000VA / 2400 watt power handling capability supports a variety of networking, telecom and other sensitive electronic devices
- Large internal batteries offer runtimes of 23 minutes at half load (1500VA / 1200 watts) and 7 minutes at full load (3000VA / 2400 watts)
- Runtime is further expandable with optional external BP24V33 battery packs
- Automatic Voltage Regulation (AVR) circuits maintain 120V nominal output over an input voltage range of 87-140V
- Includes 8 fully protected outlets (4 NEMA 5-15R & 4 NEMA 5-15/20R) with 2 single outlet load banks that can be individually powered off and back on again via software interface
- PowerAlert UPS monitoring and unattended shutdown software enables configurable network broadcast messaging, pager & email notification, event logging and running user defined script commands
- Offers simultaneous monitoring of up to 3 directly connected devices through included DB9 contact closure and RS-232 enabled interfaces, or the monitoring of any number of additional servers over IP with included PowerAlert monitoring software
- In addition to the contact closure monitoring of on battery, low battery and power restored messaging, built-in RS-232 interface supports messaging of UPS and line power status, including AC line voltage, DC battery voltage and remaining battery capacity
- Supports activate self-test and UPS output power control for scheduled or immediate reboot of connected equipment
- Diagnostic LEDs (indicate 17 performance conditions)
- UL (USA), cUL (Canada), NOM (Mexico), FCC Class A (Emissions)
- $250,000 Ultimate Lifetime Insurance (USA & Canada Only)

TYPICAL APPLICATIONS

- Ideal for the protection of communication equipment including: routers, hubs, switches, IP-PBX, Traditional PBX and Key/Hybrid Telephone Systems. Also ideal for the protection of data processing equipment such as fileservers, workstations and other sensitive devices requiring clean, continuously regulated output power. Extended runtimes are available using additional external battery packs (BP24V33).

OPTIONS & ACCESSORIES

- External battery pack: BP24V33
- Dataline protectors: DNET1, DTEL2, DCATV
- Circuit Tester: CT120
- Power Distribution: RS-1215-20, RS-1215, PDU1220, PDU1215
- Extended warranties: 3 Year WEXT3-2200-3000, 5 Year WEXT5-2200-3000

PACKAGE INCLUDES

- SMART 3000NET UPS System
- PowerAlert Software and three 6 foot network cables
- Warranty information
- Instruction manual

COMPLETE SPECIFICATIONS

SYSTEM OVERVIEW

System overview:	Line interactive tower UPS protects internetworking and telecommunications equipment from blackouts, brownouts, overvoltages, surges and line noise. Maintains AC output during blackouts and continuously corrects brownouts and overvoltages from 87 to 140 volts back to normal 120V levels. Supports external battery packs for extended runtime. Includes 3 built-in DB9 serial ports, PowerAlert UPS monitoring software and two customized load management receptacles.
Voltage compatibility:	120 V AC
Frequency compatibility:	60 Hz

OUTPUT

Output volt amp capacity (VA):	3000
Output watt capacity (watts):	2400
Output nominal voltage:	120V AC
Output voltage regulation:	LINE MODE: Sine wave line voltage 120V (-13% / +5%) BATTERY MODE: PWM sine wave output 120V +/-5%
Output frequency regulation:	LINE MODE: Passes line frequency of 60Hz +/-10% BATTERY MODE: Inverter output regulated to 60Hz +/-0.5Hz
Outlet quantity / type:	8 outlets (4 NEMA 5-15R / 4 NEMA 5-15/20R)
Customized load management receptacles:	2 individually controllable outlets support automated load shedding and remote reboot on demand of locked network devices. Configurable via PowerAlert software to automatically switch off optional loads, like monitors, to increase available runtime for servers and other critical devices.
Overload protection:	Yes, via 35A input breaker and two 15A output load breakers

INPUT

Maximum input amps:	22A, 2600 watts

Input connection type:	NEMA L5-30P
Input cord length:	8 ft.
Recommended electrical service:	30A 120V

BATTERY

Full load runtime:	7 minutes (3000VA), add 1 BP24V33 for 20 minutes
Half load runtime:	23 minutes (1500VA), add 1 BP24V33 for 53 minutes
Expandable battery runtime:	Supports extended runtime with optional BP24V33 external battery pack (multi-pack compatible)
DC system voltage:	24 V DC
Typical battery lifespan:	3-6 years, depending on usage
Battery recharge rate:	2-4 hours to 90%

VOLTAGE REGULATION

Voltage regulation description:	Line interactive UPS offers 2 boost levels of brownout correction and a single level of overvoltage adjustment to maintain usable, computer grade output without consuming battery power.
Overvoltage correction:	Input voltages between 127 and 140V AC are reduced by 10%
Direct pass through:	Input voltages between 110 and 127V AC are passed through unchanged
Brownout correction:	Input voltages between 95 and 105V AC are boosted by 12%
Severe brownout correction:	Input voltages between 87 and 94V AC are boosted by 22%

LEDS ALARMS & SWITCHES

Front panel LEDs:	Includes 5 front panel LEDs to indicate BATTERY CHARGE LEVEL, AC LINE POWER STATUS, VOLTAGE REGULATION STATUS, UPS LOAD LEVEL and BATTERY LOW / REPLACE information
Alarms:	Audible alarm with 15 second delay sounds to indicate loss of utility power. Alarm can be silenced by pressing front panel alarm cancel button. Once silenced, alarm will re-sound when approximately 2 minutes runtime remain.
Switches:	Includes 2 front panel switches — one on/standby power switch and one dual function "alarm cancel" / "self test" button, plus 1 rear panel system enable switch

SURGE / NOISE SUPPRESSION

AC surge suppression:	480 joules
AC suppression response time:	Instantaneous
EMI / RFI AC noise suppression:	Yes

PHYSICAL

Shipping weight (lbs):	96
Shipping weight (kg):	43.6
Unit weight (lbs):	89
Unit weight (kg):	40.4
Unit Dimensions (HWD/in):	17 x 9 x 12.5
Unit Dimensions (HWD/cm):	43.2 x 22.9 x 31.75
Shipping Dimensions (HWD/in):	22.25 x 12.75 x 16.5
Shipping Dimensions (HWD/cm):	57.2 x 32.4 x 42
Material of construction:	PVC
Form factors supported:	Tower
Cooling method:	Convection

ENVIRONMENTAL

Operating Temperature:	+32 to +104 degrees Fahrenheit 0 to +40 degrees Celsius
Storage Temperature:	+5 to +122 degrees Fahrenheit -15 to +50 degrees Celsius
Relative Humidity:	0 to 95%, non-condensing
Line mode BTU/hr. (Max.):	209.2
Battery mode BTU/hr. (Max.):	709.6

COMMUNICATIONS

Network monitoring port:	Includes 3 built-in DB9 monitoring ports, 1 enabled with RS-232 data communications and 2 with standard contact closure communications. All interfaces support on battery, low battery and power restored messaging. RS-232 enabled port adds data regarding AC line voltage, DC battery voltage, load percentage, battery charge current, battery capacity, internal UPS temperature and line frequency status messaging. Supports individual reboot of selected items connected to load management receptacles and load shedding to increase battery runtime for the most critical loads.
Software and cabling included:	Includes PowerAlert UPS monitoring software and complete cabling

LINE / BATTERY TRANSFER

Transfer time from line power to battery mode:	2-4 milliseconds
Low voltage transfer to battery power:	Switches to battery power as line voltage decreases to 87 volts or less.
High voltage transfer to battery power:	Switches to battery power as line voltage increases to 140 volts or higher.

CERTIFICATIONS

Certifications:	UL1778 (USA), cUL (Canada), FCC Class A (emissions), NOM (Mexico)

WARRANTY

Optional coverage:	3-5 year warranties, plus next day and on-site warranty coverage available for select opportunities. Contact Tripp Lite for additional information
Product warranty:	2 year product warranty
Connected equipment insurance (USA and Canada Only):	$250,000 connected equipment insurance (USA / Canada only)

SPECIAL FEATURES

Appearance:	Attractive gray tower UPS

BATTERY PACK ACCESSORY (optional)

Battery Pack Accessory (optional):	BP24V33

The policy of Tripp Lite is one of continuous improvement.
Specifications are subject to change without notice.
Therefore, your product may vary slightly from what is currently listed.

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Federal Signal Visalert® Strobe Light

Model VALS

Strobe Warning Light

- ***Available in 12 & 24VDC or 120 & 240VAC***
- ***Four available lens colors***
- ***4,000 hour, strobe tube***
- ***Flush or surface mounts on Federal Signal audible signalling devices or panel mount***
- ***UL-Listed and CSA-Approved for indoor/ outdoor use***
- ***Meets NEMA Type 3R requirements; constructed to IP44***

Federal Signal's Visalert® is a three dimensional, triangular warning light designed to be mated with Federal Signal's model 350 Vibratone® horn and model 50GC SelecTone® speaker/amplifiers. The model VALS can also be used as a stand alone device. Visalert is available in four lens colors: amber, clear, green and red.

Knockouts on the model 50GC and the model 350 audible devices make for easy mounting and wiring. The units can be either independently or simultaneously wired with the audible device. Model VALS uses a linear strobe tube, and all circuitry is contained within the lens.

Visalert units are recommended for use in industrial applications and any other situation where effective visual warning is needed. The Visalert can be flush or surface mounted on the model 350 horn or model 50GC speaker/amplifier.

Federal Signal's Visalert® Strobe light is an affordable, low maintenance strobe light with a compact size that is perfect for control panel applications.

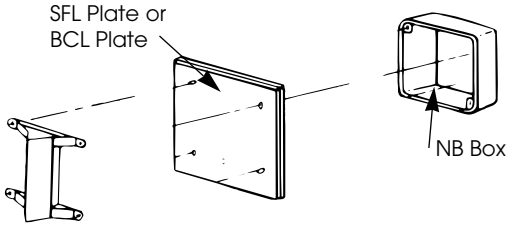
Model	Voltage	Operating Current	Flash Rate/ Minute	Peak[1] Candlepower	Mount
VALS	12VDC	0.18 amps	60	108,000	Surface
VALS	24VDC	0.08 amps	60	108,000	Surface
VALS	120VAC 50/60Hz	0.06 amps	60	108,000	Surface
VALS	240VAC 50/60Hz	0.03 amps	60	108,000	Surface

[1] Peak candlepower is the maximum light intensity generated by a flashing light during its light pulse

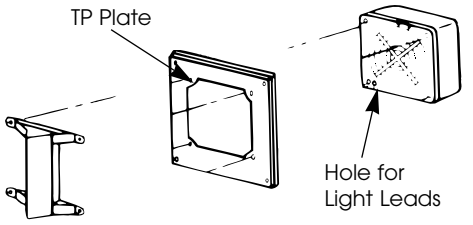
FEDERAL SIGNAL CORP. 2645 Federal Signal Dr., University Park, IL 60466 (708) 534-4756 • FAX: (708) 534-4852

Visalert Strobe Light (VALS)

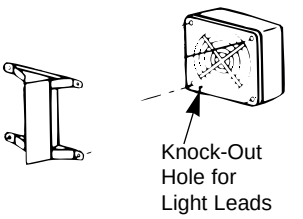
Surface-Mounted Light



Flush-Mounted 50GC Speaker



Surface-Mounted 50GC Speaker



SPECIFICATIONS

Operating Temperature:	-31°F to 150°F	-35°C to 66°C
Lamp Style:	Strobe	Strobe
Lamp Life*:	4,000 Hours	4,000 hours
Net Weight:	0.1 lbs.	.057 kg
Shipping Weight:	0.25 lbs.	0.113 kg
Height:	$3^{7}/_{8}$"	98.4 mm
Diameter:	$3^{15}/_{16}$"	100 mm

*Optimal hours under ideal conditions.

RATINGS

- UL-Listed and CSA-Approved
- Approved for NEMA Type 3R applications
- Constructed to IP 44

HOW TO ORDER

- Specify model, voltage and color, and optional accessories

REPLACEMENT PARTS

Description	Part Number
Lens, Amber	K8435D539A
Lens, Clear	K8435D539A-02
Lens, Green	K8435D539A-03
Lens, Red	K8435D539A-07
Strobe Tube	K149128A

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